

# **SDMS US EPA REGION V -1**

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September 22, 1997

Elizabeth A. Wallace, Esq.  
Assistant Attorney General  
Environmental Bureau  
Office of Illinois Attorney General  
100 W. Randolph Street, 11th Floor  
Chicago, Illinois 60601

Re: **Evergreen Manor TCE Site, Winnebago County, Illinois**  
**IEPA No. L-2010400015**

Dear Ms. Wallace:

By letter dated April 14, 1997, the Attorney General's Office provided additional technical information and indicated that the State plans to manage the above-referenced site within the Superfund program. In an effort to avoid further unwarranted enforcement actions against Ecolab Inc. (Ecolab), this letter responds to the information provided in your letter by enclosing a report by Conestoga-Rovers & Associates (CRA) entitled "Groundwater Flow Analysis Report" dated September 1997.

In short, this case is about trichloroethylene (TCE) contamination. Ecolab never used TCE. None of the soil or groundwater samples collected on Ecolab's property ever contained TCE. Based on CRA's review and the information submitted in Ecolab's letter dated January 31, 1997 (including CRA's "Contaminant Source Evaluation" dated January 1997), there is no basis to believe that Ecolab is responsible for the TCE and other volatile organic compound (VOC) contamination at the Evergreen Manor TCE Site. Accordingly, Ecolab respectfully reiterates its request that the State withdraw the "Notice" of potential liability issued pursuant to the Illinois Environmental Protection Act § 58.9(b) and refrain from pursuing further enforcement efforts against Ecolab under state or federal law.

**I. Ecolab Did Not Use TCE.**

From the earliest samples collected by the Illinois Department of Public Health (IDPH) in 1990, TCE always has been the primary contaminant of concern at this site. As the IDPH stated in the

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enclosed Fact Sheet dated February 1991, "Trichloroethylene (TCE) is the predominant compound detected." The more extensive sampling described in the IEPA's Screening Site Inspection Report dated September 1992 and Expanded Site Inspection Report (undated) confirms that TCE is the primary contaminant of concern at this site.

Again, Ecolab did not use TCE. In further support of this fact, Ecolab encloses the sworn affidavit of Brian P. Tracy, the Senior Manufacturing Engineer at Ecolab's plant at Highway 251 and Rockton Road near Roscoe, Illinois. Moreover, none of the groundwater samples collected from the monitoring wells on Ecolab's property or the soil gas survey samples (collected by Lockheed Engineering in June 1992 for U.S. EPA/IEPA) have ever detected TCE on Ecolab's property. Given that Ecolab never used TCE at its plant and never released TCE on its property, there is no basis to consider Ecolab responsible for the TCE contamination at the Evergreen Manor Site residential wells approximately two miles southwest of Ecolab's plant.

## **II. Data Confirms That Ecolab Did Not Contribute To The Evergreen Manor VOC Contamination.**

As set forth in CRA's January 1997 "Contaminant Source Evaluation" report, all available data confirms that Ecolab has not contributed to VOC contamination at the Evergreen Manor TCE Site. Again, TCE has never been observed in soils or groundwater at Ecolab and the December 1996 test results found no evidence that Ecolab's property is a prior or ongoing contaminant source.

### **A. Substances Other Than TCE Are Not Causing Unacceptable Risk.**

The State's sole remaining allegation, then, against Ecolab appears to be that Ecolab used small amounts of two solvents other than TCE, specifically 1,1,1-trichloroethane (1,1,1-TCA) and perchloroethylene (PCE). Ecolab did use small amounts of 1,1,1-TCA and PCE beginning at the earliest during 1975 - 1978 and ending in 1991, but Ecolab never disposed of these materials on site. Indeed, the Illinois Environmental Protection Agency (IEPA) inspected Ecolab's facility in May 1983 due to the extremely high levels of TCE contamination found at the Warner Electric TCE Site and found "no evidence of chlorinated solvent mismanagement" at Ecolab.

Nonetheless, the State has asserted that PCE detected in groundwater samples from monitoring well G103 (near the former railroad tracks along the western edge of Ecolab's property) suggests that Ecolab may be responsible for contamination in the residential wells some two miles southwest of Ecolab's property. In fact, only two of the hundreds of samples gathered at the Evergreen Manor residential wells even detected quantifiable levels of PCE in the range of the Maximum Contaminant Level (MCL) for PCE (5 ppb). Because TCE and not PCE is the contaminant of concern, the low level of PCE detected in monitoring well G103 has no bearing on the TCE contamination problem at the Evergreen Manor subdivisions. In sum, Ecolab's usage

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of small amounts of 1,1,1-TCA and PCE in no way suggests that Ecolab should be responsible for the VOC contamination at the Evergreen Manor TCE Site.

**B. Groundwater And Potential Contaminants Flow Too Slowly To Implicate Ecolab.**

Even though Ecolab did not use TCE and did not dispose of 1,1,1-TCA or PCE on its property, the IEPA has suggested that hypothetical spills of 1,1,1-TCA and PCE theoretically could have migrated from Ecolab's property to the Evergreen Manor subdivisions. In reliance on a pump test conducted by D'Appolonia in 1983 at the Warner Electric TCE Site, the IEPA suggests that a spill would take approximately 4.3 years to travel the approximately 11,000 feet from the Rockton Road area (where Ecolab is located) to the Rock River. The enclosed "Groundwater Flow Analysis Report" by CRA squarely contradicts this suggestion.

Without repeating the detail in the CRA report, numerous problems with use of the D'Appolonia data and analyses demonstrate that it would greatly overstate the groundwater velocity value. For example, the aquifer test assumed an aquifer thickness of only 100 feet, when all of the regional and area-specific information consistently indicates an aquifer depth of more than 200 feet. CRA has identified a number of other problems with the 1983 aquifer test and data, which when not accounted for in the analysis will result in an overestimation of the hydraulic conductivity. As a result, the D'Appolonia aquifer test is unreliable and greatly overstates the groundwater flow velocity in the area.

By contrast, Allen Wehrmann of the Illinois State Water Survey, Department of Energy and Natural Resources conducted studies of the area which culminated in the 1984 report on his investigation of a VOC plume in northern Winnebago County, Illinois. This report has been incorporated in large part into U.S. EPA's resource document, Contamination of Ground Water: Prevention, Assessment, Restoration, Pollution Technology Rev. No. 184 (1990). Based on the groundwater flow velocity calculations prepared by Mr. Wehrmann, groundwater originating in the area of Rockton Road would require somewhere in the range of 30 years to migrate to the Rock River. Further, any contaminants in the groundwater would be retarded first by the process of adsorption as they move through soils and would flow even more slowly than the groundwater. Given this time lag, it is not possible for any hypothetical spills of 1,1,1-TCA or PCE (which Ecolab did not use until 1975-1978 at the earliest) to migrate to the Evergreen Manor area (where TCE was discovered in 1990, or earlier, if Mr. Wehrmann's 1983 findings are considered).

**C. The Groundwater Flow Direction Does Not Implicate Ecolab.**

The groundwater elevation data gathered by CRA in November and December 1996 demonstrates that there is a westerly component of groundwater flow in the area of Ecolab's

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property along Rockton Road. CRA and the IEPA agree that the groundwater flow direction is generally toward the southwest. As shown by figure 2.1 of CRA's report dated September 1997, the monitoring point more than one mile west of the Ecolab property on Rockton Road is sufficiently far away to demonstrate that a westerly component of flow extends beyond Ecolab's property boundaries along Rockton Road. Thus, a hypothetical spill on Ecolab's property would not flow directly to the Evergreen Manor subdivisions approximately two miles southwest of Ecolab.

The IEPA has stated that the Evergreen Manor TCE plume is very narrow. Indeed, when the narrow plume geometry is considered relative to the westerly component of groundwater flow approximately two miles north of the subdivisions, it is clear that the source of contamination should be closer to the subdivisions and not in the vicinity of Ecolab's property along Rockton Road.

### **III. NPL Listing Is Unwarranted And Any Listing Should Not Refer To Ecolab As A PRP.**

The State has indicated that plans are underway to place this Site on the National Priorities List (NPL) pursuant to 40 C.F.R. § 300.425 and that this is the "only option which will allow for the provision of the public water supply for the affected residents." It seems doubtful that NPL listing is the only option available. In fact, the enclosed Illinois Department of Public Health Fact Sheet of February 1991 recommended a simpler remedy. In light of the complexity and costs added by NPL listing, several factors suggest that this site should not be listed on the NPL.

First, as indicated in the IDPH Fact Sheet, the TCE levels generally are not high enough to warrant emergency response action. Thus, U.S. EPA involvement does not seem warranted. Second, the complexity of proceeding with handling this site under the NPL program will duplicate agency oversight efforts and increase the costs accordingly. By contrast, the nearby Warner Electric TCE Site was not placed on the NPL despite the much more significant TCE contamination detected there.

Third, this site generally appears appropriate for remediation by means of natural attenuation in light of the low concentration and disperse nature of contaminants in the groundwater, along with the lack of any known potentially significant source area. Based upon existing groundwater quality data, the Evergreen Manor Site should meet the criteria established in the U.S. EPA's draft Directive on Monitored Natural Attenuation (OSWER, June 9, 1997) for remediation by natural attenuation. Approximately 28% of the public water supply wells in Winnebago County have been impacted by quantifiable levels of VOCs without resulting in numerous NPL actions. During the investigation of the nearby Warner Electric TCE Site by Allan Wehrmann in 1984, levels of TCE in the range of 4 ppb were found in the Tressemer and Olde Farm subdivisions. These levels were not significant enough to warrant response action at the time. Consistent with

this approach, natural attenuation may resolve this situation without the cost and administrative proceedings associated with the cumbersome NPL, remedial investigation/feasibility study (RI/FS), and remedial design/remedial action (RD/RA) processes initially proposed by the State.

In any event, the State should not refer to Ecolab as a potentially responsible party if the State refers this matter to the U.S. EPA for NPL listing or other enforcement. Ecolab did not cause the TCE and other VOC contamination at the Evergreen Manor Site subdivisions. "Further, the NPL is only of limited significance, as it does not assign liability to any party or to the owner of any specific property." 62 Fed. Reg. 15,594 (April 1, 1997). For the reasons given above, any referral of this matter to the U.S. EPA should not suggest that Ecolab is a potentially responsible party.

#### **IV. The Warner Electric TCE Plume May Be A Potential Source.**

The Illinois EPA suggests that the TCE plume at Warner Electric is not contaminating the private wells in the Tressemer, Olde Farm, Evergreen Manor, and Hononegah Heights subdivisions. Again, it should be noted that the Wehrmann report of August 1984 on the Warner Electric TCE Site documented the presence of quantifiable levels of TCE in the subdivisions now associated with the Evergreen Manor Site. While the comparatively low TCE levels in the subdivisions associated with the Evergreen Manor TCE Site may not warrant a response action, these low levels of TCE do not suggest that the TCE came from some place other than Warner Electric's TCE plume.

The chemical match of the two nearby areas of contamination suggests that the Warner Electric TCE plume may well be the source of the TCE contamination found at the Evergreen Manor area due to diffusion. Depth-specific monitoring wells have not been installed or sampled in the area between the Warner Electric TCE plume and the residential wells impacted at the Evergreen Manor subdivisions. Without such depth-specific data, it is improper for the State to rule out the Warner Electric TCE plume as the source of the TCE problem at issue. Moreover, CRA's "Contaminant Source Evaluation" report dated January 1997 identifies several other potential sources that should not be ignored.

#### **V. There Is No Basis To Impose Liability On Ecolab.**

Because Ecolab has no connection with TCE contamination at the Evergreen Manor TCE Site, the State should refrain from further enforcement efforts against Ecolab. Ecolab is not an owner, operator, or person who arranged for disposal of hazardous substances that resulted in a release or threatened release of TCE within the meaning of Section 22.2(f) of the Illinois Environmental Protection Act or Section 107(a) of the Comprehensive Environmental Response, Compensation, and Liability Act.

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Section 58.9(a)(2) specifically prohibits enforcement against: "A person who neither caused nor contributed to in any material respect a release of regulated substances on, in, or under the site that was identified and addressed by the remedial action taken. . . ." 415 ILCS § 5/58.9(a)(2)(A). In this case, any remedial action would be to address TCE contamination caused by parties other than Ecolab. As Ecolab neither caused nor contributed to the TCE contamination, the State should withdraw from further enforcement actions against Ecolab.

## VI. Conclusion

In sum, Ecolab is not responsible for the TCE and other VOC contamination at the Evergreen Manor TCE site. Before the State proceeds with further enforcement actions or referral efforts to the U.S. EPA against Ecolab, we request that this information be fully considered. Accordingly, we again request that the State refrain from pursuing further enforcement efforts against Ecolab and withdraw the "Notice" of potential liability.

We look forward to the State's response at your earliest convenience.

Sincerely,



Steven M. Christenson  
SMC/sfs

### Enclosures:

1. IDPH Fact Sheet (Feb. 1991)
2. CRA Groundwater Flow Analysis Report (Sept. 1997)
3. B. Tracy Affidavit (Aug. 1997)

c: Gerald E. Willman/IEPA  
Paul R. Jagiello/IEPA  
William D. Seith/IAG (also enclosing Jan. 31, 1997 submittals and Wehrmann report)  
Howard O. Chinn/IAG (also enclosing Jan. 31, 1997 submittals and Wehrmann report)  
Frederick S. Mueller/Johnson & Bell, Ltd.  
Richard G. Shepherd/Conestoga-Rovers & Associates

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February, 1991

F A C T   S H E E T

Regarding Groundwater Contamination  
In Evergreen Manor, Hononegah Heights  
& Olde Farm Subdivisions

INTRODUCTION:

A number of weeks ago the Illinois Department of Public Health (IDPH) was asked to sample a water well in one of the above subdivisions for Volatile Organic Chemicals (VOCs). The analysis results indicated significant levels of VOCs in the well water. IDPH began sampling other wells in the area to determine the extent of the contamination. To date, 108 wells have been sampled. VOCs were not detected in every well sampled. Where found, total VOC levels ranged from trace amounts to 149 parts per billion (ppb). A part per billion is equal to one drop in 15,000 gallons.

The chemicals detected are trichloroethylene, 1,1,1-trichloroethane, 1,1-dichloroethene, 1,1-dichloroethane, and cis-1,2-dichloroethene. Most of these compounds are common solvents and degreasers used in a variety of industrial and commercial processes. Trichloroethylene (TCE) is the predominant compound detected. The highest concentration of TCE in any sample is 76 ppb. TCE was also the predominant contaminant found in the wells in a neighboring subdivision, Hononegah Country Estates, eight or nine years ago. In this case TCE concentrations exceeded 5000 ppb.

The United States Environmental Protection Agency (USEPA) and the Illinois Environmental Protection Agency (IEPA) were informed of the initial and all subsequent findings. USEPA responded immediately and has assisted in the sampling effort as has the Winnebago County Health Department.

A relatively narrow contaminant plume has been identified and is outlined on the attached diagram.



### WHAT ARE THE HEALTH EFFECTS FROM EXPOSURE TO THESE COMPOUNDS?

Most of the available information concerning the health effects associated with exposure to these compounds comes from animal and occupational exposure studies. Unfortunately, these types of studies provide toxicological information based on high levels of exposure. The levels of human exposure to VOCs that may occur in the environment, particularly in groundwater, are many times lower than the levels of exposure in these studies. The human health risks associated with low level, environmental exposure to these compounds are extrapolated (estimated) from these animal and occupational studies. This extrapolation procedure contains many assumptions and uncertainties. Therefore, at this time there is not an accurate or reliable method of determining the true human health risks from long term low level exposure to these compounds in the environment.

### RECOMMENDATIONS:

Although there are presently no health standards for these compounds in private water supplies, the United States Environmental Protection Agency has established standards for some of these compounds in public water supplies. These standards are called Maximum Contaminant Levels (MCLs). An MCL is set at a level at which there is no increased risk of adverse health effects. The following is a list of the compounds detected during our sampling activities and their corresponding MCLs (if available).

| <u>COMPOUND</u>          | <u>MCL</u>          |
|--------------------------|---------------------|
| 1,1-dichloroethylene     | 7.0 ppb             |
| cis-1,2-dichloroethylene | 70.0 ppb (Proposed) |
| 1,1-dichloroethane       | None                |
| 1,1,1-trichloroethane    | 200.0 ppb           |
| trichloroethylene        | 5.0 ppb             |
| tetrachloroethylene      | 5.0 ppb             |

The potential routes of exposure to these compounds from household use of contaminated water include consumption of drinking water, and skin absorption and inhalation of contaminants from activities such as showering or bathing. However, consumption of water is the primary route of exposure to these compounds.

Based on the above preliminary information and the degree of contamination, our Department is making the following recommendations in regard to water usage in the contaminated area.

- 1) Degree of Contamination: All water supplies with total chlorinated ethylene levels in excess of 50 parts per billion. Chlorinated ethylene compounds include cis-1,2-dichloroethylene, 1,1-dichloroethylene, trichloroethylene, and tetrachloroethylene. This level of contamination corresponds roughly to a one in 100,000 excess risk of adverse chronic health effects from a lifetime of exposure to these compounds in drinking water.

Recommendation: It is this Department's opinion that exposure to these compounds should be lessened by reducing the consumption of contaminated water. Therefore, we recommend the use of bottled water or the installation of an adequate sized activated carbon filter for drinking purposes.

- 2) Degree of Contamination: All water supplies with less than 50 ppb total chlorinated ethylenes and a trichloroethylene level greater than its MCL of 5 ppb.

Recommendation: Although the level of trichloroethylene exceeds its MCL, the degree of risk is minimal and may not warrant a reduction in exposure to the water supply. This decision is left to the individual water supply users.

- 3) Degree of Contamination: Remaining water supplies having a slight level of contamination.

Recommendation: These compounds are present at levels below their respective MCLs or any other health guidelines. Therefore, it is not necessary to alter consumption of this water.

#### STATUS:

Households that have not been sampled can obtain a good estimate of VOC levels in their water supply by their location on the attached diagrams.

The source of the contamination is unknown at this time. Groundwater and thus the contaminants are moving gradually in a southerly direction towards the river. Since the groundwater moves very slowly, if the source could be identified and removed today, it would still take years for the contaminants to pass through the subdivisions.

U.S.E.P.A. has evaluated all sample results taken thus far and has determined that TCE levels (76 ppb) are not high enough for emergency response action. The Removal Action Level (RAL) established for TCE by the federal government is 128 ppb. This site will now be evaluated by the USEPA Remedial Action section for possible future cleanup.

The Illinois Department of Public Health and the Winnebago County Health Department will continue to monitor this plume and work with the appropriate agency in trying to identify the source of contaminants. Every effort will be made to keep you informed of any new developments.

If you have any questions on any of this information, feel free to call this office at 815/987-7511.

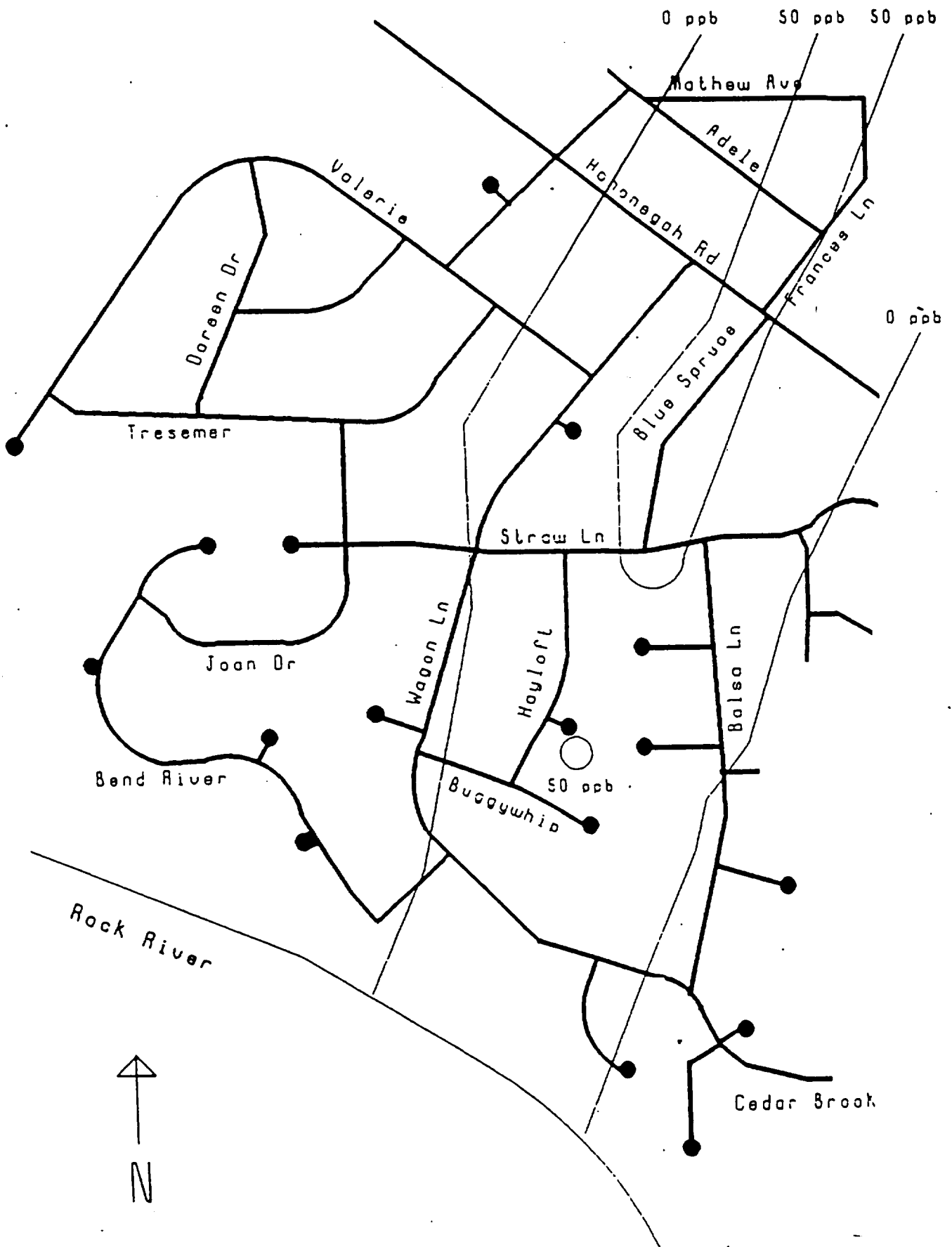
#### INFORMATIONAL RESOURCES

|   |              |
|---|--------------|
| Roger Ruden - IL. Dept. of Public Health    | 815/987-7511 |
| Ken Theisen - U.S.E.P.A. Emergency Response | 312/886-1959 |
| Jim Anderson- Winnebago Co. Health Dept.    | 815/962-5092 |
| Stan Black - IL. EPA Community Relations    | 217/785-1427 |

Listed above are telephone numbers and names of persons you may contact for information.

# TCE CONTAMINATION

(February 1991)



# **GROUNDWATER FLOW ANALYSIS REPORT**

## **EVERGREEN MANOR SITE**

**Prepared for:  
Ecolab Inc.**

# **GROUNDWATER FLOW ANALYSIS REPORT**

## **EVERGREEN MANOR SITE**

**Prepared for:**  
**Ecolab Inc.**

**SEPTEMBER 1997**  
**REF. NO. 9234 (2)**  
This report printed on recycled paper

**CONESTOGA-ROVERS & ASSOCIATES**

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FIGURE 2.1      LOCATION OF 1983 D'APPOLONIA AQUIFER TEST



## 1.0 INTRODUCTION

Since 1990, the Illinois Environmental Protection (IEPA) has investigated groundwater conditions at the Evergreen Manor Site in Roscoe, Illinois. The primary contaminant detected above drinking water standards (Federal Safe Drinking Water Act Maximum Contaminant Levels - MCLs) in the Evergreen Manor Site Subdivisions has been trichloroethene (TCE).

The IEPA has defined the Evergreen Manor Site so as to include the Evergreen Manor, Olde Farm, Hononegah Heights and possibly the Tresemer Subdivision where groundwater has been impacted by TCE at concentrations exceeding the MCL and by other chlorinated solvents at concentrations below MCLs. The IEPA also has investigated certain industrial and commercial properties located along Highway 251 and Rockton Road including properties owned by Waste Management of Wisconsin Inc. (formerly AAA Disposal System Inc.), Regal-Beloit Corp., and Ecolab Inc. (Ecolab) and each company was issued a Section 58.9 (b) notice by the IEPA by letter dated September 30, 1996. Additional commercial and industrial facilities are located in the vicinity of the Evergreen Manor Site.

Ecolab, Waste Management, and Regal Beloit Corp. individually responded to IEPA's notice(s). Ecolab's response included a letter dated January 31, 1997 and a report prepared by Conestoga-Rovers & Associates (CRA) "Contaminant Source Evaluation, Evergreen Manor Site" Conestoga-Rovers & Associates (January 1997).

The Evergreen Manor Site has been distinguished by IEPA from the nearby Warner Electric Site which includes the Hononegah Country Estates Subdivision and Moorehaven Subdivision. The Warner Electric Site involves the contamination of groundwater, also by TCE and other chlorinated solvents, which originates at the Warner Electric facility along Highway 251 and McCurry Road and extends toward the Rock River. Similar chemicals have been detected in the groundwater at the Warner Electric Site as those detected at the Evergreen Manor Site, predominantly TCE.

The purpose of this report is to analyze the comments provided by the Illinois Environmental Protection Agency (IEPA) in the letter issued by the Office of the Attorney General on April 14, 1997 in response to Ecolab's January 31, 1997 letter and CRA's January 1997 report. The information provided by the IEPA in the April 14 letter was in reference to groundwater flow and contaminant transport issues at the Evergreen Manor Site. This groundwater flow analysis report has been prepared by CRA for Ecolab Inc. and addresses the five major comments raised by the IEPA in the agency's April 14, 1997 response. The five comments made by the IEPA are summarized below and discussed by CRA in the following sections of this report:

- 1) The IEPA contends that groundwater flow velocities calculated by the agency result in much faster contaminant transport times, which then allow for more recent releases at potential source areas to the north to cause contamination in private wells at the Evergreen Manor subdivisions (see CRA's discussion in Section 2.0, page 4).
- 2) The IEPA contends that the plume of TCE contamination associated with the Evergreen Manor Site is distinct from the plume of TCE contamination originating at the Warner Electric Site (see CRA's discussion in Section 3.1, page 20).
- 3) The IEPA contends that groundwater flow in the vicinity of Rockton Road and areas north of the Evergreen Manor subdivisions is in a southwest direction aligned with the TCE plume at the Evergreen Manor Site (see CRA's discussion in Section 3.2, page 21).
- 4) The IEPA contends that the lower concentrations of volatile organic compounds (VOCs) at potential source areas to the north in comparison to those measured in private wells at the Evergreen Manor Site do not rule out their contribution to the plume identified in the subdivision wells (see CRA's discussion in Section 3.3, page 22).
- 5) The IEPA contends that the Agency has identified all significant potentially responsible parties within or very close in proximity to the identified plume (see CRA's discussion in Section 3.4, page 23).

The majority of this report (see Section 2.0) responds to the discussion by the IEPA regarding its calculation of the average groundwater velocity at the Site. The basis of the IEPA's determination of groundwater velocity (and associated comments regarding more recent releases of contamination) is an aquifer test performed in 1983 at the Warner Electric Site and the test analyses performed by D'Appolonia Waste Management Services (consultant to Warner Electric). In reviewing the issues raised by the IEPA it is apparent that the major difference in the conceptual hydrogeologic models developed by the IEPA and by CRA relate to the velocity of groundwater movement and the direction of flow from potential source areas near Rockton Road. The IEPA's conceptual model incorporates an extremely fast groundwater flow rate with a gradient and direction aligned directly between the impacted private wells in the Evergreen Manor Subdivision and potential sources located along Rockton Road and north of the subdivisions. Whereas, the CRA conceptual model relies upon a slower, more reasonable rate of groundwater flow and incorporates groundwater flow directions that are not aligned with the plume and indicate a more westerly flow of groundwater in the vicinity of Rockton Road.

The IEPA has used a hydraulic conductivity value (which can be the dominant aquifer parameter affecting the calculation of groundwater velocity) derived from the 1983 D'Appolonia aquifer test completed in an area and at a depth which are not representative of hydrogeologic conditions in the flow path of contaminated groundwater at the Evergreen Manor Site. In addition, the analyses of the aquifer test data ignored Site specific hydrogeologic conditions and other hydraulic influences. These conditions result in the over estimation of hydraulic conductivity. The problems with the aquifer test analyses performed at the Warner Electric site and used by the IEPA to form the basis for travel time calculations at the Evergreen Manor Site will be discussed in further detail in the following section of this report along with CRA's comments on other points made by the IEPA.

## 2.0 GROUNDWATER FLOW CALCULATION COMMENTS

The following discussions review the methods and underlying assumptions used by D'Appolonia at the Warner Electric Site and relied upon by the IEPA to determine the velocity of groundwater at the Evergreen Manor Site. This velocity calculation is then ultimately used by the IEPA to determine the time of travel for contaminants (Volatile Organic Compounds, or VOCs) from potential source areas along Rockton Road to the private wells in the Evergreen Manor Site.

CRA's analysis of the IEPA's comments on groundwater flow calculations is organized into five sections. The assumptions used by the IEPA and calculation methods of the groundwater velocity are presented in Section 2.1. The hydraulic conductivity (which is an important parameter in the calculation of groundwater velocity) relied upon by the IEPA is discussed in Section 2.2. The aquifer test performed by D'Appolonia in 1983 to determine the hydraulic conductivity (relied upon by IEPA) is discussed in Section 2.3. An overview of area-wide hydrogeologic conditions which affect the aquifer test and affect the analysis of the test data are discussed in Section 2.4. In Section 2.5, CRA summarizes the major problems associated with the use of the 1983 D'Appolonia aquifer test and its results in determination of hydraulic conductivity. The problems identified by CRA result in an overestimation of hydraulic conductivity; which then results in an overestimation of groundwater velocity by the IEPA at the Evergreen Manor Site.

### 2.1 GROUNDWATER VELOCITY CALCULATIONS

The IEPA calculated an interstitial velocity (average linear velocity or velocity) of seven (7) feet/day for the Evergreen Manor Site based upon a hydraulic conductivity derived from aquifer tests performed at the Warner Electric Brake and Clutch (Warner Electric) facility and analyzed by their consultant (D'Appolonia) in 1983. The velocity was calculated using the following parameters:

- hydraulic conductivity (K) of 5951 gpd/ft<sup>2</sup>

- effective fluid porosity ( $n_e$ ) of 0.25 ; and
- average horizontal hydraulic gradient ( $i$ ) of 0.0022 ft/ft.

Where the average linear velocity ( $V_s$ ) is defined as:

$$V_s = \frac{Ki}{n_e}$$

Using the above parameters determined at the Warner Electric Site, the IEPA calculated for the Evergreen Manor Site, an average linear velocity of seven feet/day or over 2,500 feet year. Their conclusion was that groundwater containing VOCs and originating in the northern sections of the Evergreen Manor Site could travel the approximately 11,000 feet from the Rockton Road area in less than five years. This extremely rapid groundwater velocity could then be used, the IEPA stated, to explain the VOC contamination of groundwater at the Evergreen Manor and other subdivisions near the Rock River. The source of the VOC contamination is attributed by the IEPA to be from yet unidentified releases of chemicals at the potential source areas located near Rockton Road. Thus, the IEPA suggests that groundwater contaminated by spills or other releases near Rockton Road (approximately two miles away) could impact the private wells at the subdivision of Evergreen Manor and other nearby subdivisions in less than five years.

The hydraulic conductivity value used by the IEPA in their velocity calculation for the Evergreen Manor Site was derived from an aquifer test at the Warner Electric Site, and this is discussed below.

## 2.2 HYDRAULIC CONDUCTIVITY RELIED UPON BY THE IEPA

In contrast to their selection of a high value of hydraulic conductivity, the IEPA does rely on reasonable and representative values of horizontal hydraulic gradient and of the effective fluid porosity for the given hydrogeologic conditions at the Evergreen Manor Site. The hydraulic

conductivity value, however, is subject to more uncertainty as a result of the nature of the aquifer test from which it was derived. The hydraulic conductivity value of 779 ft/day assumed by the IEPA at the Evergreen Manor Site is based upon one of two aquifer tests (both within the area of the Warner Electric Site) presented in a memorandum prepared by RMT in July 1992. (Attachment 2 to the April 14 letter from the Attorney General's Office). Specifically, the two aquifer tests summarized by the IEPA in the Agency's April 14, 1997 letter include:

- 1) Pumping of a production well at the Warner Electric facility in August 1983 and the measurement of water levels at nearby monitoring wells. The collection of field data and analysis of the aquifer test data were performed by D'Appolonia Waste Management Services (D'Appolonia) and presented in a report "Site Investigation/Initial Remedial Measure" (September 1983).
- 2) Pumping of an extraction well located south of the Warner Electric facility and apparently less than 500 feet from the Rock River. The extraction well was pumped and water levels measured in nearby monitoring wells during the fall of 1991. This aquifer test was performed and analyzed by Roy F. Weston (Weston, November 1991). Apparently this extraction well was installed as part of the TCE remedial action program implemented by Weston for Warner Electric.

The approximate location of the 1983 D'Appolonia aquifer test is illustrated in Figure 2.1 along with the outline of groundwater streamlines originating at areas near Rockton Road. The IEPA has only relied on results calculated by D'Appolonia in this first aquifer test in calculating groundwater velocity for the Evergreen Manor Site.

The two aquifer tests (see Attachment 2 of the April 14, 1997 letter from the Attorney General's Office) were discussed in a summary memo prepared by Gene McLinn of RMT on July 21, 1992. The RMT memo also provided an overview and analysis of the Weston (1991) aquifer test. The conclusion of the RMT memo was that the most representative average transmissivity value was 78,000 ft<sup>2</sup>/day. The IEPA, however, relied on only the

data from the 1983 aquifer test analyzed by D'Appolonia, where an average transmissivity of 595,127 gpd/ft<sup>2</sup> or approximately 79,560 ft<sup>2</sup>/day was calculated.

The IEPA used the same value of saturated thickness (D) of the aquifer tested as did D'Appolonia in their 1983 analysis; 97 feet (which was subsequently rounded to 100). This thickness value is based upon the depth of the production well pumped (well No. 3) at the Warner Electric facility. Since hydraulic conductivity (K) is equal to the transmissivity (T) divided by the saturated thickness (D) or:

$$K = T/D$$

Therefore, relying on the D'Appolonia aquifer test analyses, the IEPA calculated for the Evergreen Manor Site, a hydraulic conductivity (K) value of 779 ft/day. Again, this is based upon an assumed average saturated aquifer thickness (D) of about 100 feet.

The methods and assumptions used in the 1983 D'Appolonia aquifer test at the Warner Electric Site are described below.

### 2.3 EVALUATION OF THE 1983 D'APPOLONIA AQUIFER TEST IN DETERMINATION OF HYDRAULIC CONDUCTIVITY

Since the IEPA relies specifically on the hydraulic conductivity value determined from the 1983 D'Appolonia aquifer test at the Warner Electric Site analysis to determine groundwater velocity at the Evergreen Manor Site, the methods used to analyze these data and their underlying assumptions must be reviewed in detail. Moreover, the methods used and the assumptions made by D'Appolonia must be reviewed in light of actual conditions in the Warner Electric Site tested area and in light of hydrogeologic conditions at the Evergreen Manor Site.

The 1983 D'Appolonia aquifer test took place at the Warner Electric facility which is located 3,500 feet to the east of the impacted wells at the Evergreen Manor subdivision and approximately 6,000 feet south of Rockton

Road. The test involved pumping of one of the production wells (Well No. 3) at the Warner Electric facility while the other two production wells (No. 1 and 2) were shut down. Production well No.3 is 97 feet deep and 16 inches in diameter. The other two production wells were shut down for 12 hours prior to the start up of the pumping test. The information provided in Attachment 2 does not specify how long production wells No. 1, 2 and 3 had been pumping prior to shutdown. It is assumed, however, that these wells provided water to the facility on a continuous basis for production and cooling water purposes and, therefore, had been used recently if not continuously prior to the start of the aquifer test.

The aquifer test consisted of pumping well No. 3 from August 6, 1983 (7:44am) to August 7 (5:05 pm) and collecting water levels at existing monitoring wells located at various distances from the pumped well. The wells monitored the most frequently were those within 300 feet of production well No. 3. The monitoring wells selected for monitoring were less than 100 ft deep, with some as shallow as 35 feet.

The monitoring wells used by D'Appolonia in the aquifer test analysis included :

| <i>Well ID</i> | <i>Total Depth</i> | <i>Distance From Pumped Well</i> |
|----------------|--------------------|----------------------------------|
| MW-6S          | 36 ft              | 264 ft                           |
| MW-7D          | 57 ft              | 250 ft                           |
| MW-11D         | 61 ft              | 25 ft                            |
| MW-12D         | 61ft               | 75 ft                            |

D'Appolonia monitored water levels in other monitoring wells but these were at distances greater than 300 feet from the pumped well and responses either were not measurable, or were not useful in aquifer test analyses. D'Appolonia relied upon data from the above four monitoring wells to estimate transmissivity and hydraulic conductivity.



Two methods of data analysis were applied by D'Appolonia to calculate hydraulic conductivity and ultimately relied upon by the IEPA in their calculation of groundwater velocity:

- The Jacob Straight Line Method; and
- The Theis Curve Match Method.

The Jacob method is derived from the Cooper-Jacob (1946) analytical solution which is an approximation of the Theis solution (1935). The Jacob method solves for transmissivity through a plot of drawdown vs. time on a semilogarithmic scale graph. The Theis method solves for transmissivity using type curves and matching of drawdown vs. time/radius(squared) on a log-log scale graph. Both methods require the following hydraulic and geologic conditions to hold for the analysis to be correct:

- horizontal flow to the well ( no vertical component of flow within the aquifer);
- all storage of water comes from the cone of depression (the aquifer is isolated from local recharge);
- fully penetrating pumping wells and observation wells ( well depths and screen intervals span the saturated thickness of the aquifer);
- the aquifer behaves under confined conditions and there is instantaneous release of groundwater from storage;
- prior to pumping the potentiometric surface (water table) of the aquifer is at steady state conditions; and
- the aquifer is isotropic and homogenous

These are the basic assumptions required for the Theis (1935) analytical solution as stated by Kruseman and De Ridder (1976). An additional

requirement of the Jacob approximation method for straight line solutions is that the data selected must be at large values of time and/or small values of the radial distance from the pumping well.

The aquifer test methods and underlying assumptions must match with the given configuration of the pumping test and the nature of hydrogeologic conditions in the Evergreen Manor Site in order for the analysis to be valid. The next section describes area-wide hydrogeologic conditions which should have formed the basis of the aquifer test analysis completed by D'Appolonia in 1983.

#### 2.4 BACKGROUND HYDROGEOLOGIC CONDITIONS AT THE WARNER ELECTRIC SITE AND AT THE EVERGREEN MANOR SITE

In general, the underlying geology of the Warner Electric and the Evergreen Manor Site areas comprises sands and gravels of the Rock River alluvium and glacial deposits. Geologic conditions are similar in the general area with exceptions related to the proximity to the Rock River and the variation of deposits with depth. The deposits are predominantly gravely sands and sandy gravels with depths of over 250 feet. The thickness of the alluvial and glacial deposits is based upon:

- notes on the boring log for Monitoring Well VPB-1 drilled by Weston in 1991 at the Warner Electric Site which indicated bedrock at a depth of 265 feet (see Attachment 2 of the April 14 letter);
- The CERCLA Expanded Site Inspection Report (pp 23) prepared by the IEPA for the Evergreen Manor Site;
- Appendix G of the CERCLA Screening Site Inspection Report (Hononegah Country Estate Wells #1 and #2) which provided well logs from the Evergreen Manor Site area which demonstrated the presence of sands and gravels to depths of over 250 feet;

- geologic cross sections by Berg, et. al. 1984 (pp 21) which indicated close to 250 feet of alluvium in the area of the Warner Electric facility; and
- the 1984 report by Wehrman which indicated the thickness of the Rock River alluvium in the Warner Electric and Evergreen Manor Site area to be greater than 200 feet.

Most of the drilling logs for the deep wells in the general area and those provided in previous reports have indicated a generally fining upward sequence in the Rock River alluvium and glacial outwash deposits. The upper 40 to 60 feet of these deposits are generally fine to medium sands with some gravels. The deeper deposits are comprised of coarser sands and increased gravel percentages (Berg, et. al., 1984). In addition, regional studies have indicated that the alluvial deposits are coarser near the margins of the Rock River; as would be expected in a river depositional environment (Berg, et. al., 1984).

On a large scale basis the alluvial and glacial deposits can be assumed to be isotropic and homogeneous, however, this cannot be assumed on a Site specific basis or in the evaluation of pumping test data. The upper deposits (to average depths of 60 feet) for the most part comprise finer grained sands which exhibit a lower horizontal hydraulic conductivity value than the deeper deposits (CERCLA Screening Site Inspection Report). The deeper deposits, which consist of coarser sands and zones of gravels and cobbles, are more transmissive and exhibit a higher hydraulic conductivity than the upper zones. Consequently, the horizontal movement of groundwater in the upper system would be expected to be at a slower rate than the deeper system under the same hydraulic gradient.

Existing information for the Evergreen Manor Site indicates that in the area of the potential source areas identified by the IEPA (near Rockton Road and along the flow path toward the Evergreen Manor subdivision), that the vertical hydraulic gradients are negligible to minimal. This is supported by the water level data collected in the monitoring well clusters installed by the IEPA. Consequently, groundwater flowing in the upper portions of the alluvial

deposits along this flow path would tend to remain within the shallow zone. Movement of shallow groundwater into the deeper, coarser zone of the aquifer would be gradual, if at all. Only deep pumping from a production well or other supply well would create significant downward vertical hydraulic gradients. However, large capacity production wells are not known to exist along the flow path from the Rockton Road area with the possible exception of wells at the Kelley Sand & Gravel operation.

There are no continuous zones of low permeability material in the Site area such as clays or silts which would act as a regional confining layer to the Rock River alluvium and glacial deposits. Consequently, groundwater flow within these deposits is generally under unconfined conditions. The Storage Coefficients (Specific Yield) values calculated in the D'Appolonia (1983) and Weston (1991) aquifer test analyses indicated a range of values corresponding to an unconfined aquifer.

The hydrogeologic conditions described above are important to consider as they should form the basis of assumptions relied upon in the 1983 D'Appolonia aquifer test analyses. If the actual hydrogeologic conditions are not incorporated into the aquifer test analysis, then an inaccurate hydraulic conductivity value will be calculated.

## 2.5 PROBLEMS WITH USE OF THE 1983 WARNER ELECTRIC SITE AQUIFER TEST DATA AND THE RESULTS PRESENTED BY D'APPOLONIA (AUGUST 1983)

In the April 14, 1997 letter, the IEPA relies upon the transmissivity and hydraulic conductivity values determined in the aquifer test analyses performed in 1983 by D'Appolonia at the Warner Electric facility within the Warner Electric Site. The following sections discuss problems identified by CRA in the use of data collected in the 1983 aquifer test and in the methods of data analysis relied upon by the IEPA. Some of the same concerns and problems identified by CRA for the 1983 aquifer test also apply to the aquifer test and data analyses performed by Weston in 1991.

### 2.5.1 Aquifer Thickness

The first and foremost problem or inconsistency with the use by IEPA of the 1983 D'Appolonia values for hydraulic conductivity is due to the assumed thickness of the aquifer, or the total saturated thickness (D). The values of transmissivity and hydraulic conductivity relied upon by the IEPA for the Evergreen Manor Site were calculated by D'Appolonia (August 1983) using the Theis method and Jacob approximation method as described above. The hydraulic conductivity value (which can be the most important or sensitive parameter in the calculation of average linear groundwater velocity) is then calculated by D'Appolonia by dividing the transmissivity value by an assumed aquifer thickness (D) of 100ft. D'Appolonia uses this value because it corresponds to the depth of production well No. 3 which was pumped for the test. The summary table (4-1) presented in the August 1983 report by D'Appolonia includes calculated transmissivities (T) ranging from 542,466 gpd/ft to 690,361 gpd/ft. The corresponding hydraulic conductivity (K) range is from 726 ft/day to 836 ft/day. The average hydraulic conductivity calculated by D'Appolonia was 779 ft/day. Again, these values were based upon an assumed aquifer thickness of 100 ft.

The aquifer thickness used by D'Appolonia is inaccurate and neither represents actual conditions in the area of the aquifer test (at the Warner Electric Site), nor does it represent actual conditions at the Evergreen Manor Site. As mentioned earlier in Section 2.4, the actual thickness of the alluvial deposits in the area of the Warner Electric Site is on the order of 250 feet. If it is assumed that the depth to groundwater in this area is on the order of 20 feet below grade, then the saturated thickness of the aquifer would be on the order of 230 feet and not 100 feet. If it is also assumed that (at a minimum) 200 feet best represents the thickness of the saturated alluvial deposits at the Warner Electric Site, then the calculated hydraulic conductivity would be only approximately 50% of the value calculated by D'Appolonia. Therefore, using the actual saturated thickness of the alluvial aquifer (instead of the depth of the production well) would result in an hydraulic conductivity of at least 390 ft/day, if all the other components of the aquifer test analysis were held to be valid.

The average linear groundwater flow velocity calculated using the reduced value of hydraulic conductivity would be:

$$V_s = K \times i / n_e \text{ or, } v = (390 \text{ ft/day} \times .0022 \text{ ft/ft}) / 0.25$$

$$V_s = 3.4 \text{ ft/day or approximately 1200 feet per year.}$$

Using the IEPA calculated distance from the potential source areas along Rockton Road to the Evergreen Manor subdivision of 11,000 feet, the time for groundwater (and non-retarded contaminants) to move this distance by advection is over 9 years, and not the 4.3 years suggested by the IEPA. The revised velocity estimate (3.4 ft/day) however, assumes that the remaining assumptions used by D'Appolonia in their analysis of the 1983 test data are valid, which they are not. The hydraulic conductivity should also be reduced from that calculated above by CRA (using actual saturated thickness) as a result of these additional complications, which are described below.

#### 2.5.2 Partial Penetration Effects

The second problem associated with the 1983 D'Appolonia hydraulic conductivity data as applied by IEPA at the Evergreen Manor Site is the lack of correction for partial penetration of the aquifer by production and observation wells. Specifically, that the pumped well is only 100 feet deep in a 250 foot thick aquifer and that most observation wells were less than 65 feet deep). Additionally, the data were not analyzed using a solution which accounts for partial penetration effects (i.e. Neuman, 1974; Hantush, 1964, etc.). Partial penetration effects occur when a pumping well only partially screens the total saturated thickness of the aquifer. This phenomenon results in the creation of vertical flow around the pumped well and the observation wells, therefore invalidating the horizontal flow assumption required under the Theis solution (Kruseman and De Ridder, 1976). Partially penetrating pumping wells can result in larger than expected drawdowns in the pumped well and very little drawdown in the observation wells as a result of the vertical components of flow into the pumped well (Bear, 1979 pp 344). Consequently, the groundwater

flowing to the partially penetrating pumped well includes deeper formation water located proximate to the well and less contribution from lateral radial flow where the observation wells are located.

Conditions during the pumping test in 1983 at the Warner Electric Site likely resulted in the preferential capture of deeper groundwater (from the underlying deposits) during pumping of production well No. 3. Groundwater capture in a radial-lateral direction would be restricted due to these partial penetration effects. This is evident from the lack of significant drawdown in the shallow observation wells located nearest to the production well, and the nine feet of measured drawdown in the production well itself. Again, the effects of this problem resulted in IEPA's overestimation of hydraulic conductivity, transmissivity and, ultimately a larger value of groundwater velocity. The partial penetration effects are in addition to the problem created by using a too small of a aquifer thickness; both result in an overestimation of hydraulic conductivity.

### 2.5.3 Unconfined / Leaky Aquifer Conditions

The third problem related to the IEPA's use of 1983 pumping test data is that D'Appolonia incorrectly assumed that the aquifer was confined. The Rock River alluvium and the glacial deposits, however, are not confined in the area of the aquifer test. This is supported by the lack of any continuous geologic confining unit across the area and the measured water levels, which do not indicate that the formations are under pressure.

In addition, CRA's review of the water level data from observation wells monitored during the 1983 Warner Electric aquifer test and from observation wells monitored during the Weston aquifer test (1991) indicate that delayed yield (leaky) conditions also are present at these test sites. Leaky conditions occur when there is vertical movement of groundwater under transient pumping conditions (from the water table) which results in delayed recharge to the pumping well. Leaky conditions, if not accounted for in an aquifer test analysis also result in an overestimation of hydraulic conductivity. The unconfined and leaky aquifer conditions are not solved for in the Theis and

Jacob analytical methods used by D'Appolonia in their 1983 aquifer test analyses, and these conditions invalidate the underlying assumptions.

By ignoring the unconfined and leaky aquifer conditions in the aquifer test analysis, D'Appolonia has made significant errors in the calculation of aquifer transmissivity. These errors are such that the uncorrected results will over estimate the transmissivity of the aquifer (Neuman, 1972, pp 1285). Consequently, even with a correction for partial penetration and adjustment for the proper thickness of the aquifer, the D'Appolonia aquifer test analysis has overestimated the actual hydraulic conductivity value for the deeper deposits which were tested. Consequently, IEPA's reliance on this 1983 aquifer test and the analytical methods without correction for these leaky conditions results in additional overestimation of the groundwater velocity.

#### 2.5.4 Steady State Pre-Pumping Conditions

The fourth problem in use of the 1983 D'Appolonia aquifer test results by the IEPA in relation to the Evergreen Manor Site is the lack of proper correction for pre-pumping test water level trends and acknowledgment of un-steady conditions at the start of the test. CRA's review of the aquifer test performed at the Warner Electric Site in 1983 has indicated that the test was performed when equilibrium (steady state) conditions were not present. The Warner Electric facility operated three production wells and two of them apparently were operating prior to the start of the aquifer test. D'Appolonia allowed only a 12 hour period of water level recovery (production well shut down) prior to initiation of pumping at the third well. There is no indication in the information provided (Attachment 2 of the April 14, 1997 letter) that the 12 hours were sufficient to reach steady state water level conditions and to eliminate any rising water level trend which would complicate the aquifer test. In fact, the plots of drawdowns for monitoring wells MW-12D and MW-11D indicate an early time slope which appears to be the result of the superposition of a recovery trend (shut down of the two other production wells) on the initial drawdown trend from pumping at the third production well. This trend exists to almost 1000 minutes into the pumping period of the test.



The superposition of the existing water level recovery trend on the drawdown due to pumping of the production well resulted in a lower net drawdown measured in observation wells. Analysis of these drawdown data during the 1983 aquifer test, without accounting for the superposition of the existing recovery trend, resulted in the overestimation of the transmissivity and hydraulic conductivity.

#### 2.5.5 Deeper Formation Tested

The fifth and final concern with the 1983 aquifer test at the Warner Electric facility and D'Appolonia's analysis of those data relates to the zone or depth of the deposits which were tested. The zone screened in the pumped production well was from 65 to 97 feet below grade. At this depth, the deposits comprise coarser sands and more gravels than the shallow zone.

As mentioned previously, however, the contamination in the subdivisions associated with the Evergreen Manor Site generally is limited to depths of less than 60 feet. The shallow zone where VOCs are migrating comprises fine to medium grained sands. Groundwater flow velocities would be expected to be slower in the shallow, finer grained sands. Consequently, even if the aquifer test had been performed correctly and the data analyzed using the appropriate solutions, the zone tested would not be representative of the hydraulic conductivity of the material where contaminants (VOCs) are migrating. Again, testing of the coarser grained, deeper deposits results in the overestimation of hydraulic conductivity and groundwater velocity which would not be representative of the shallower zone at the Evergreen Manor Site.

#### 2.6 SUMMARY OF CRA'S ANALYSIS OF THE GROUNDWATER VELOCITY CALCULATIONS RELIED UPON BY THE IEPA

The hydraulic conductivity value can be a sensitive parameter in the calculation of groundwater velocity and ultimately in the migration rate of contaminants in the groundwater. In relation to the Evergreen Manor Site, the IEPA has used a hydraulic conductivity value which is calculated

inappropriately from aquifer tests performed at the Warner Electric Site in 1983. This value is not only incorrect for the given depth and location of the aquifer zone tested at the Warner Electric Site, moreover the zone tested is itself, not representative of the shallower deposits where contaminants are migrating in the Evergreen Manor Site.

Specifically, the aquifer test analyses and subsequent groundwater velocity calculations used by the IEPA in the April 14, 1997 letter fail to account for:

- 1) the actual thickness of the aquifer (alluvial deposits in the area of the Warner Electric Site are approximately 250 feet thick);
- 2) the effects of pumping wells and observation wells which partially penetrate the aquifer;
- 3) the unconfined and delayed yield (leaky) aspects of the aquifer tested;
- 4) previous pumping conditions and the superposition of an existing recovery trend on the pumping test data; and
- 5) the differences between shallow deposits where contaminants are migrating and the deeper zone where the pumping test was performed.

On these bases, the groundwater velocity value presented by the IEPA in the April 14, 1997 letter from the Attorney General's Office is not accurate and does not represent conditions at the Evergreen Manor Site. The existing aquifer test data (both the D'Appolonia test in 1983 and the Weston test in 1991) do not provide representative information for use in calculating groundwater travel times in the shallower deposits from Rockton Road to the Evergreen Manor Site subdivisions.

If the contamination of private wells was first discovered in 1990, then groundwater containing contaminants would have to be present in the area of Rockton Road in the early 1960s. However, the chemical releases from

any potential sources in this area of the Site would need to occur prior to this timeframe to account for:

- travel time through the forty feet of unsaturated soils; and
- soil and groundwater retardation/attenuation along the flow path.

The values of hydraulic conductivity calculated by Wehrman (1984) in an investigation of the area by the Illinois Department of Energy and Natural Resources (State Water Survey Division) are more representative of the aquifer zone where contaminants are migrating at the Evergreen Manor Site. These values were determined from in-situ testing at a number of locations and in wells completed at depths corresponding to the shallow zone of contamination. Whereas, the IEPA relies on a single aquifer test completed in deposits which are deeper than those along the contaminant flow path at the Evergreen Manor Site. The large values of groundwater velocity relied upon by the IEPA are therefore, not helpful in determining dates of potential releases at the suspect source areas identified by the IEPA near Rockton Road. It is CRA's opinion that contaminant travel time from the vicinity of Rockton Road to the private wells in Evergreen Manor would be closer to 30 years (based upon issues discussed above and the aquifer analyses performed by Wehrman in 1984), than the unrealistic value of four to five years proposed by the IEPA.

### 3.0 ADDITIONAL COMMENTS

This section of the report address of the other four specific points made by the IEPA in the April 14, 1997 letter.

#### 3.1 THE RELATIONSHIP OF WARNER ELECTRIC'S TCE PLUME TO THE EVERGREEN MANOR SITE TCE PLUME

The IEPA's discussion of the Warner Electric TCE plume in the April 14 letter refers to houses (and their private wells) which are located between the Warner Electric TCE plume and the Evergreen Manor subdivision. The IEPA states that because VOCs were not detected in these intermediate residential wells, that this supports the hypothesis that there are two plumes originating from separate sources. The IEPA relies, however, on private water supply wells and samples collected from these wells to make this conclusion. Depth specific monitoring wells have not been installed and sampled in this same area of the Evergreen Manor Site. It is possible, given the low concentration of VOCs along Hononegah Road, that the private well samples are diluted by the pumping action of the water well or that the screened interval is too deep to accurately monitor a shallow contaminant plume in this area.

The concentrations of VOCs in the area of the Evergreen Manor are considered by CRA to be both consistent and comparable to the lateral spreading (dispersion) of VOCs from the center of a plume originating at the Warner Electric facility. Until depth specific monitoring wells are installed and sampled in this area between Evergreen Manor and Warner Electric, it is not possible to rule out VOC contribution from the Warner Electric facility.

#### 3.2 GROUNDWATER FLOW DIRECTIONS DETERMINED IN THE AREA OF ROCKTON ROAD IN COMPARISON TO REGIONAL FLOW DIRECTIONS

The IEPA discusses the usefulness of developing groundwater flow directions on a Site wide basis versus on a more local,

property specific basis. CRA does not disagree with the IEPA in their April 14 letter that groundwater flow in the Site area is to the southwest and toward the Rock River. Water level data collected at depth specific wells, in the upper sand zone where contaminants would be migrating in the area of Rockton Road, however, indicate that there is a larger westerly component of groundwater flow than that predicted by the IEPA. As indicated in Figure 2.1, groundwater originating in the area of Rockton Road does not align with the center of the narrow plume at the Evergreen Manor subdivision, but rather trends slightly west of this area. This groundwater flow direction is based upon water level data collected beyond the Ecolab property boundary, with monitoring wells as far apart as 5800 feet (northwest/southeast direction). The spatial distribution of monitoring points used by CRA is greater than the distribution of monitoring wells used to define the groundwater plume and flow directions at the Warner Electric Site. Therefore, the groundwater flow directions determined by CRA (January 1997) are more representative of flow at the Evergreen Manor Site.

It is important to note that the IEPA relies on an aquifer test at a specific property (the Warner Electric facility) to support groundwater velocity and source timing arguments for the Evergreen Manor Site as a whole, and yet the Warner Electric Site is considered to be a separate Site from the Evergreen Manor Site. According to the IEPA in the April 14, 1997 letter the contaminants at the Warner Electric Site can not be related to conditions at the Evergreen Manor Site. The same argument used by the IEPA in the April 14, 1997 letter in not accepting groundwater flow directions developed from property specific studies can be applied to the hydraulic conductivity data developed at Warner Electric Site. The IEPA has improperly used a hydraulic conductivity value from a property specific test (at the Warner Electric facility in the Warner Electric Site) and applied it to the Evergreen Manor Site.

### 3.3 VOC CONCENTRATIONS AT AREAS NEAR ROCKTON ROAD ARE LOWER THAN VOC CONCENTRATIONS AT THE EVERGREEN MANOR SUBDIVISIONS

As a fundamental principle of contaminant hydrogeology, contaminant concentrations generally are highest near the source of the

contamination. In this case, concentrations of VOCs at potential sources identified to the north near the Rockton Road area, are lower in comparison to those detected in the private wells at the Evergreen Manor Subdivision. Thus, using the traditional interpretation of this apparent reverse concentration gradient, one would conclude that the source of contamination should be closer to the higher concentrations of VOCs detected in the subdivision wells. However, the IEPA suggests in the April 14, 1997 letter that a slug or historical plume of VOCs has moved past the source areas and the center of the mass is now away from the source area property and detected at the subdivision wells.

The IEPA's theory that a slug of VOCs has moved through the Site does not match with the value of groundwater velocity used by the IEPA in the agency's source/timing arguments. The IEPA assumes that a groundwater velocity of seven feet/day will result in the movement of VOCs from potential source areas in the northern part of the Evergreen Manor Site, near Rockton Road, rapidly to the Rock River and the Evergreen Manor subdivisions within a four to five year period. Under this scenario, the sources of the contamination would be more recent and residual contamination (which should be detected at significantly higher concentrations than the non-detected to low parts per billion levels measured in the area of Rockton Road) should still be present in the source area in both soils and groundwater. The soil, soil gas and groundwater data collected by the IEPA at properties along Rockton Road and at other areas to the north of the Evergreen Manor Subdivision indicate only low concentrations of VOCs (CERCLA Screening Site Inspection Report and CERCLA Expanded Site Inspection Report). The IEPA's soil gas survey conducted on the Ecolab property in 1992 found no VOCs. The low to non-detectable concentrations of VOCs in soils and groundwater at potential sources are not representative of recent contaminant releases (last four to five years). There are, therefore, inconsistencies in the comparison of source releases and the groundwater velocity rates (contaminant migration rates) postulated by the IEPA with the actual Site data. These inconsistencies do not occur if a slower groundwater flow rate is used and additional, nearby sources (such as Kelly Sand and Gravel and, Warner Electric) are assumed to be the cause of VOC contamination.

Additionally, there are inconsistencies between the IEPA's theory of a historical slug or plume of VOCs migrating from northern source areas and the shape of the observed plume at the subdivisions. First, as mentioned previously, groundwater flow in the area of Rockton Road has been measured to have a westerly component which does not align with the center of the plume at the Evergreen Manor Site. Consequently, any historical slug of VOC contamination would not have traveled in this direction. Second, the narrow shape (lateral distribution of VOCs in groundwater) of the plume does not match with a slug type source located two miles upgradient of the subdivision. If the slug of contamination had originated at locations this far upgradient of the subdivision, then contamination would have had the opportunity to spread-out over a larger area (as a result of lateral dispersion) and the shape of the plume would have changed with time (assuming the postulated IEPA groundwater velocity). The existing data do not support this scenario. Again, the IEPA theory of a historical, slug-type release of VOCs does not match with the groundwater quality data.

### 3.4 UNINVESTIGATED SOURCES

In the April 14, 1997 letter the IEPA suggests that it has identified all potential sources ".....within or very close in proximity, to the identified plume". However, the IEPA has not considered other potential sources located at greater distances from the plume (which would be logical if groundwater velocity is as fast as seven feet/day), nor have they considered that the VOC contamination may be a result of a greater regional problem.

The previously submitted responses by Ecolab (January 1997), Waste Management, Inc. (February 1997) and Regal-Beloit Corporation (February 1997) identified a number of other potential sources within the plume area and those outside the plume area. In fact, the IEPA had originally identified 29 potential parties (CERCLA Site Screening Inspection Report, September 1992) and only seven have received information requests and only four notice letters. In addition, the Illinois State Geological Survey performed a review of contaminant sources (November 1995) and identified at least seven unpermitted landfills in the Evergreen Manor Site area, which have not been investigated to

date by the IEPA. Although located physically close the Evergreen Manor Site subdivisions, the Kelley Sand and Gravel facility did not receive a 104E request letter from the IEPA.

Finally, as early as 1988, a regional groundwater problem was suspected in Winnebago County. In a report prepared by the IEPA in November 1988, approximately 28 percent of the public water supply wells in Winnebago County had quantifiable levels of at least one VOC (Clarke and Cobb, November 1988). The concept of a regional groundwater problem has yet to be included in the IEPA's evaluation of the Evergreen Manor Site.

### 3.5 TCE IS THE CONTAMINANT OF CONCERN AT THE EVERGREEN MANOR SITE

Based on all the groundwater quality data provided to date, TCE is the primary contaminant exceeding Class I Standards in 35 IAC 620 or the Federal Maximum Contaminant Levels (MCLs) at the Evergreen Manor Subdivision. Although not specifically addressed in the April 14, 1997 letter from the Attorney General's Office, the IEPA has suggested that Ecolab and other potential responsible parties located along Rockton Road are included in the list of potential sources as a result of their use of perchloroethylene (PCE) in the past and its presence in the private wells located in the Evergreen Manor Subdivision (meeting at the Attorney General's Office on April 9, 1997). The IEPA has acknowledged that TCE is the primary contaminant of concern in the subdivision wells, but also indicated that PCE was present in certain of the private wells.

CRA reviewed the existing records of private well samples collected in the Evergreen Manor subdivisions as provided in the CERCLA Screening Site Inspection Report (September 1992) and the CERCLA Expanded Site Inspection Report (undated). In the first, PCE was only detected once above the Illinois 620 Groundwater Quality Standards for Class I groundwater (5 ppb). This sample was collected in December 1991 at 4566 Mathews Avenue which is located north of Hononegah Road. The sample indicated PCE present at a concentration of 5.8 ppb. In the second study, PCE was only detected in one sample at a concentration equal or greater than the Class I standard. This sample



was collected in November of 1993, and indicated an estimated (J) value of 5 ppb for PCE, however, its location (G131) is unknown as the street addresses were not available in this report.

Based upon CRA's review of currently available sample data, PCE should not be considered a contaminant of concern at the Evergreen Manor Site. Out of 45 to 50 samples collected by the IEPA in each event, only one well contained PCE at a concentration equal to or just above the Class I standard. TCE concentrations, however, are more prevalent and they are detected above the Class I standard. As mentioned in CRA's January 1997 report (Contaminant Source Evaluation-Evergreen Manor Site), the Ecolab facility has never used TCE. Moreover, TCE has never been detected in soil or groundwater on the Ecolab property. Accordingly, Ecolab cannot be responsible for the TCE contamination at the Evergreen Manor Site.

#### **4.0 SUMMARY AND CONCLUSIONS**

CRA has reviewed IEPA's information presented in the April 14, 1997 letter from the Attorney General's Office. The IEPA comments related to five technical issues or points regarding conditions at the Evergreen Manor Site and potential contributions from potentially responsible parties identified to date. The IEPA discussion centered on the migration pathways and source release timing of these potential sources in relationship to private well contamination at the subdivisions associated with Evergreen Manor. The key comments made by the IEPA in the April 14, 1997 letter are based upon extremely rapid groundwater flow (and contaminant movement) from the area of Rockton Road and a direction of flow aligned with the Evergreen Manor subdivision. Under the scenario postulated by the IEPA, it would be possible for VOCs which entered the groundwater at Rockton Road to migrate directly to the Evergreen Manor subdivisions and contaminate the private wells within a 4 to 5 year time frame.

CRA's evaluation of the technical arguments made by the IEPA in the April 14, 1997 letter regarding the first point indicate major flaws in the calculation of hydraulic conductivity and therefore groundwater flow velocity, contaminant migration rates and flow directions. The aquifer test analyses and subsequent groundwater velocity calculations used by the IEPA in the April 14, 1997 letter fail to account for:

- 1) the actual thickness of the aquifer (alluvial deposits in the area of the Warner Electric Site are approximately 250 feet thick);
- 2) the effects of pumping wells and observation wells which partially penetrate the aquifer;
- 3) the unconfined and delayed yield (leaky) aspects of the aquifer tested;
- 4) previous pumping conditions and the superposition of an existing recovery trend on the pumping test data; and

- 5) the differences between shallow deposits where contaminants are migrating and the deeper zone where the aquifer test was performed.

On these bases, the groundwater velocity value presented by the IEPA in the April 14, 1997 letter from the Attorney General's Office is not reliable. The existing aquifer test data (both the D'Appolonia test in 1983 and the Weston test in 1991) do not provide representative information for use in calculating travel times from Rockton Road to the Evergreen Manor Site subdivisions.

In their second point, the IEPA suggests that the Warner Electric TCE Plume is not related to the Evergreen Manor Site. The concentrations of VOCs in the area of the Evergreen Manor Site Subdivisions are considered by CRA to be comparable to the lateral spreading (dispersion) of VOCs from the center of a plume originating at the Warner Electric facility. Until depth specific monitoring wells are installed and sampled in this area between Evergreen Manor and Warner Electric, it is not possible to rule out VOC contribution from the Warner Electric facility.

In their third point, IEPA discusses the usefulness of developing groundwater flow directions on a Site wide basis versus on a more local, property specific basis. The spatial distribution of monitoring points used by CRA in the area of Rockton Road is greater than the distribution of monitoring wells at the Warner Electric Site. Therefore, the groundwater flow directions determined by CRA (January 1997) are more representative of flow at the Evergreen Manor Site and should not be ignored by the IEPA.

The IEPA's theory that a slug of VOCs has moved through the Site (fourth point) does not match with the low to non-detect concentrations of VOCs and the value of groundwater velocity used by the IEPA in their source/timing arguments. The IEPA assumes that a groundwater velocity of seven feet/day will result in the movement of VOCs from potential source areas near Rockton Road rapidly to the Evergreen Manor subdivisions within a four to five year period. In the event of a release in recent years, relatively high concentrations should be present near the source area. In fact, the soil, soil gas and groundwater data collected by the IEPA at properties along Rockton Road

and at other areas to the north of the Evergreen Manor Subdivision indicate only low concentrations of VOCs.

Moreover, if the slug of contamination had originated at locations this far upgradient of the subdivision, then contamination would have had the opportunity to spread-out over a larger area (as a result of lateral dispersion) and the shape of the plume would have changed with time (assuming the postulated IEPA groundwater velocity). The existing data do not support this scenario.

In the fifth point, the IEPA suggests that it has identified all potential sources ".....within or very close in proximity, to the identified plume". Whereas, the previously submitted responses by Ecolab (January 1997), Waste Management, Inc. (February 1997) and Regal-Beloit Corporation (February 1997) identified a number of other potential sources within the plume area and those outside the plume area which have not been investigated by the IEPA. In addition, as early as 1988, a regional groundwater problem was suspected in Winnebago County. The concept of a regional groundwater problem has yet to be included in the IEPA's evaluation of the Evergreen Manor Site.

In conclusion, groundwater flow and groundwater quality data for both the Evergreen Manor Site and the Warner Electric Site demonstrate that Ecolab has not contributed to the TCE and other VOC contamination of private wells located in the Evergreen Manor Site. This is further supported by the lack of any TCE use at the Ecolab facility and the lack of TCE observed in soils or groundwater on the Ecolab property.

## 5.0 REFERENCES

Bear, Jacob, 1979; Hydraulics of Groundwater, McGraw Hill Series of Water Resources and Environmental Engineering, Israel.

Berg, R.C., Kempton, J.P. and Stecyk, A.N., 1984; Geology for Planning in Boone and Winnebago Counties, Illinois State Geological Survey.

Clarke, R.P., and Clobb, R.P., November 1988; Winnebago County Groundwater Study, IEPA, P.A. 84-1108.

Conestoga-Rovers & Associates, January 1997; Contaminant Source Evaluation-Evergreen Manor Site, prepared for Ecolab Inc.

D'APPOLONIA; September 1983; Site Investigation/Initial Remedial Measures, Warner Electric Brake & Clutch Company, Roscoe, Illinois, prepared for Seyfarth, Shaw Fairwater & Geraldson, Chicago, Illinois.

Illinois Environmental Protection Agency; (undated); CERCLA Expanded Site Inspection Report, Evergreen Manor Groundwater Contamination, TDD 984-836-734

Illinois Environmental Protection Agency; September 1992, CERCLA Screening Site Inspection Report, Evergreen Manor Groundwater Contamination, ILD 984836734.

Krusemen, G.P. and de Ridder, N.A.; 1976; Analysis and Evaluation of Pumping Test Data, International Institute for Land Reclamation and Improvement, The Netherlands.

Memorandum from Gene McLian to Bob July; July 21, 1992; Pump Test Analysis for Warner Electric, Roscoe, Illinois-prepared by RMT, Inc.

Neuman, S.P., Witherspoon, P.A.; October 1992; Field Determination of the Hydraulic Properties of Leaky Multiple Aquifer Systems, Water Resources Research Article Vol. 8, No. 5.

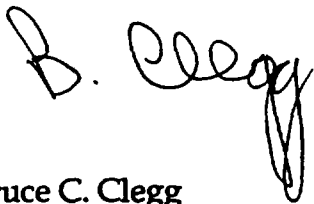
Neuman, Shlomo P.; April 1974; Effect of Partial Penetration of Flow in Unconfined Aquifers Considering Delayed Gravity Response, "Water Resources Research Article Vol. 10, No. 2," Institute of Soils and Water, Agricultural Research Organization Volcanic Center, Bet Dagan, Israel.

Wehrmann, H. Allen; August 1984; An Investigation of a Volatile Organic Chemical Plume in Northern Winnebago County, Illinois, prepared by Illinois Department of Energy and Natural Resources, State Water Survey Division, Champaign, Illinois.

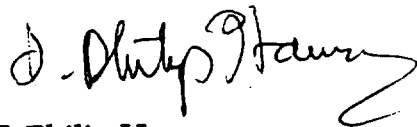
All of Which is Respectfully Submitted,  
CONESTOGA-ROVERS & ASSOCIATES

A handwritten signature in cursive script, appearing to read "R. Shepherd".

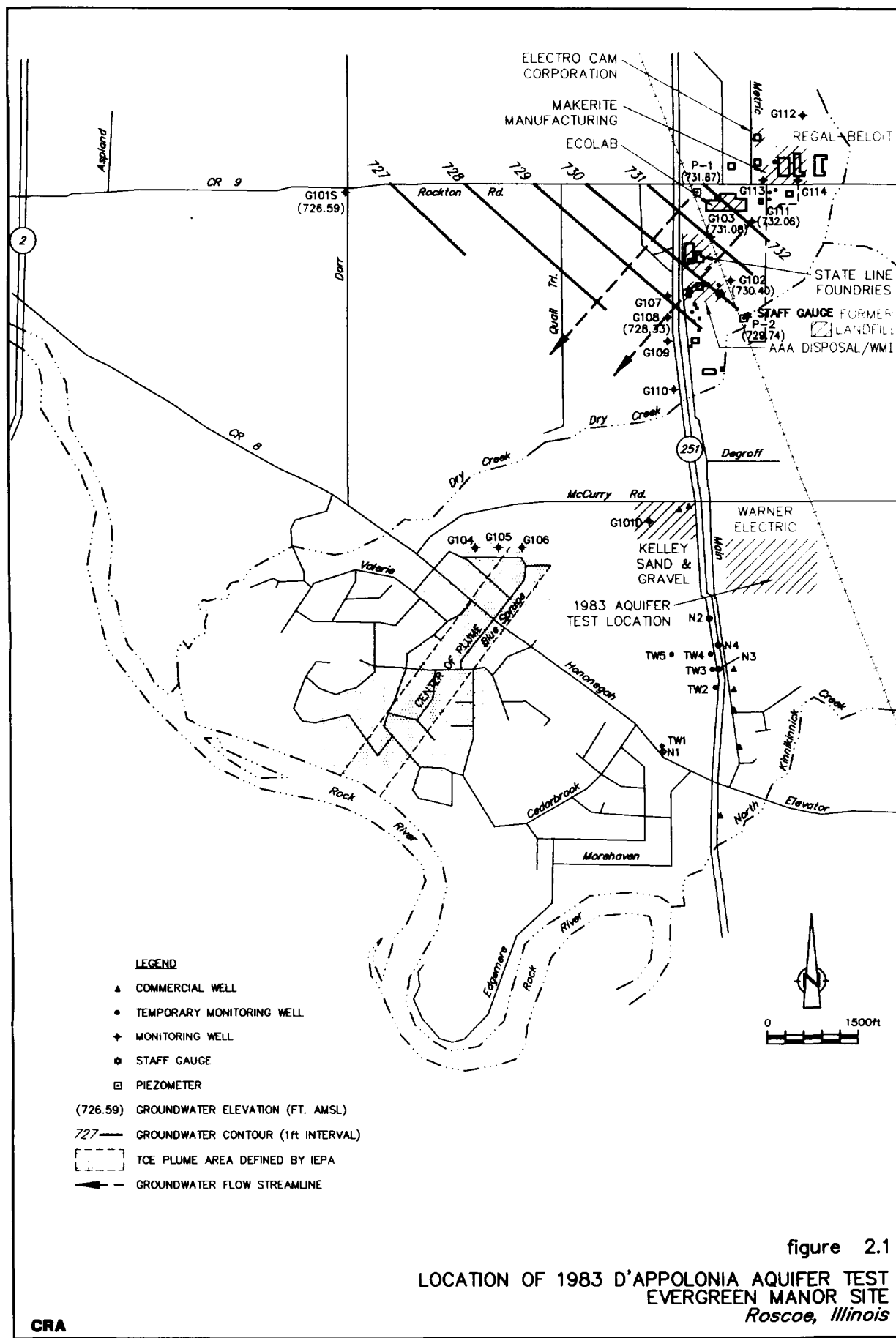
Richard G. Shepherd, P. Eng.

A handwritten signature in cursive script, appearing to read "B. Clegg".

Bruce C. Clegg

A handwritten signature in cursive script, appearing to read "J. Philip Harvey".

J. Philip Harvey



CRA



STATE OF ILLINOIS        )  
                                      )  
County of Winnebago        )

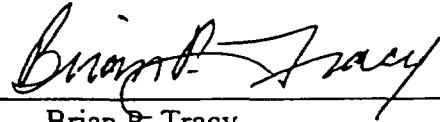
AFFIDAVIT OF BRIAN P. TRACY

BRIAN P. TRACY, first being duly sworn, deposes and says as follows:


1. I am a Senior Manufacturing Engineer with Ecolab Inc. and have worked at Ecolab's plant at Highway 251 and Rockton Road near Roscoe, Illinois since November 1990.
2. As part of my job duties, I am familiar with Ecolab's Material Safety Data Sheet (MSDS) storage and handling practices. Ecolab retains MSDS for obsolete materials used at the plant.
3. I have reviewed Ecolab's MSDS files for current and obsolete materials. Based on my review, I have attached true and accurate copies of all MSDS records for chlorinated solvents used at the plant, as follows:
  - Exhibit A     1,1,1-Trichloroethane, provided by Hydrite Chemical by letter dated January 14, 1984.
  - Exhibit B     Safe-Solv, provided by Viking Chemical by letter dated March 18, 1988.
  - Exhibit C     Magnus Solvent #2  
                  Magnus Solvent #5
4. I am aware that Ecolab used solvents to clean parts before 1991. After 1991, all use of solvents at the plant was eliminated. Based on my review of the MSDS records and my experience at the plant, the only solvents used at the plant are listed in paragraph 3. Specifically, based on my review of the MSDS records and my experience at the plant, trichloroethene (TCE) was not used at the Ecolab plant.

5. To my knowledge, no solvents were ever spilled or disposed of on the Ecolab property. Spent solvents were always properly disposed of off-site by an appropriate disposal company.

FURTHER, your Affiant sayeth not.

  
Brian P. Tracy

Subscribed and sworn to before me  
this 25<sup>th</sup> day of Aug A.D. 19 97.

  
NOTARY PUBLIC



## EXHIBIT A



# HYDRITE CHEMICAL CO.

2655 N. MAYFAIR ROAD MILWAUKEE, WISCONSIN 53226 414/257-2300

CERTIFIED MAIL  
RETURN RECEIPT REQUESTED

January 14, 1984

Economic Labs  
P.O. Box 1018  
South Beloit, IL 53511

Attn: Jan Nastasi

In the interest of worker safety, and in compliance with the Wisconsin's "Employee's Right to Know Law" (effective December 1, 1982), we have enclosed copies of the following Material Safety Data Sheets:

111 Trichloroethane (PP81)-CS-2008  
(VU82-2)-CS-2008

These Material Safety Data Sheets contain necessary information about product hazards and proper handling. This data relates only to the specific material designated and does not relate to its use in combination with any other material or process. In those cases where the Material Safety Data Sheet is stamped "Distributed by Hydrite Chemical Co." the information is that provided solely by our primary and secondary suppliers. Hydrite Chemical Co. believes that the factual data contained in the enclosed sheets are correct. The opinions expressed in them are those of qualified experts regarding the results of tests conducted; however, since conditions of use are outside our control, they are not to be taken as a warranty or representation for which Hydrite Chemical Co. assumes legal responsibility. This information is provided solely for your consideration, investigation, and verification.

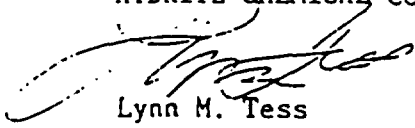
The "Employee's Right to Know Law" requires all Wisconsin companies to post a notice as outlined in Wisconsin Administration Code Section 101.581 providing specified information to employees, employee representatives and employers. Whether your Company is affected by this law or not, Hydrite Chemical Co. strongly urges you to provide the warnings and information in the enclosed Material Safety Data Sheets to your employees, customers, handlers, people exposed to, or users of any of these products.

We would appreciate it if you would fill out and return the enclosed card to verify that you have received the enclosed Material Safety Data Sheet(s).

If you have any questions, or if I can be of service in the future, please feel free to contact me.

Sincerely,

HYDRITE CHEMICAL CO.



Lynn M. Tess

Material Safety Data Sheet Coordinator

LMT/clm  
Enclosures

"OVER FIFTY YEARS OF SERVICE TO INDUSTRY"

# Material Safety Data Sheet

PPG INDUSTRIES, Inc.  
Chemicals Group  
One Gateway Center  
Pittsburgh, PA 15222



Approved by U.S. Dept. of Labor as "Essentially similar" to Form OSHA-20

|  |   |
|--|---|
| Date: January, 1931  | Edition: Fourth (PP811)-CS-2008         |
| Chemical Name and Synonyms:<br>1,1,1-trichloroethane; methylchloroform<br>CAS No.: 71-55-0 | Trade Name and Synonyms:<br>Tri-Ethane® |
| Chemical Family: Halogenated Hydrocarbons  | Formula: $\text{CH}_3\text{CCl}_3$      |
| DOT Shipping Name: 1,1,1 trichloroethane   | DOT Hazard Class: ORM-A, UN2831         |

## SECTION 1 • PHYSICAL DATA

|  |  |   |   |
|--|--|---|---|
| Boiling Point @ 760 mm Hg:<br>165.4°F  | Vapor Density (Air=1):<br>4.54             | Specific Gravity ( $\text{H}_2\text{O}=1$ ):<br>1.31 @ 25°/25°C | pH of Solutions:<br>6.0 to 7.5  |
| Freezing/Melting Point:<br>-49°F -45°C | Solubility (Weight % in Water): Negligible | Bulk Density:<br>10.84 lbs./gal. @ 25°C                         | Volume % Volatile:<br>100   |
| Vapor Pressure:<br>@ 25°C = 104.4mmHg  | Evaporation Rate<br>(ethyl ether=1): 0.35  | Heat of Solution:<br>Not Applicable                             | Appearance and Odor: Clear,<br>colorless liquid - ether-like<br>odor. |

## SECTION 2 • HAZARDOUS INGREDIENTS

|                                    | %   | Hazard Data |
|------------------------------------|-----|-------------|
| 1,1,1-trichloroethane (Stabilized) | 100 | See Below   |
|                                    |     |             |
|                                    |     |             |
|                                    |     |             |

## SECTION 3 • FIRE AND EXPLOSION HAZARD DATA

|  |  |  |
|--|--|--|
| Flash Point °F (Method Used)<br>None when tested in accordance<br>with DOT requirements. | Flammable Limits in Air (% by Volume)<br>LEL: 7% See Below<br>UEL: 15% | Extinguishing Media: Water, dry<br>chemical or carbon dioxide. |
|--|--|--|

Special Fire Fighting Procedures: Fire fighters should wear a NIOSH/MSHA-approved pressure-demand, self-contained breathing apparatus for possible exposure to hydrogen chloride and possibly traces of phosgene.

Unusual Fire and Explosion Hazards: Vapors concentrated in a confined or poorly ventilated area can be ignited upon contact with a spark, flame or high intensity source of heat. This can occur at concentrations ranging between 7-15% by volume. Decomposition or burning can produce hydrogen chloride or possibly traces of phosgene.

## SECTION 4 • HEALTH HAZARD DATA

Permissible Exposure Limits (TLV): 350 ppm - 8-hour time-weighted average (TWA) - OSHA 29CFR 1910.10 (May 28, 1975). PPG internal permissible exposure limit is 350 ppm 8-hour TWA with a short-term exposure limit (STEL) of 450 ppm for any 15-minute excursion period.

| Toxicity Data (1)  | Classification (Poison, Irritant, Etc.)                   |
|--|---|
| LC <sub>50</sub> Inhalation (rat) 8,000 ppm/7 hours          | Inhalation: Toxic   |
| LD <sub>50</sub> Dermal (rabbit) > 15g/kg <sup>(2)</sup>     | Skin/Eye: Liquid mildly irritating to skin; eye irritant. |
| LD <sub>50</sub> Ingestion (rat) 10-12gm/kg (See Section 5)  | Ingestion: Not Significantly Toxic                        |
| Fish, LC <sub>50</sub> (Lethal Concentration) Not Determined | Aquatic:  |

Human Exposure Information/Data: See Section 5

24-HOUR EMERGENCY ASSISTANCE: (304) 843-1300

## SECTION 5 • EFFECTS OF OVEREXPOSURE

This section covers effects of overexposure for inhalation, eye/skin contact, ingestion and other types of overexposure information in the order of the most hazardous and the most likely route of overexposure.

Acute: Primarily a central nervous system depressant. Inhalation can cause irritation of the respiratory system, dizziness, nausea, lightheadedness, headache, loss of coordination and equilibrium, unconsciousness and even death in confined or poorly ventilated areas. Depression of the circulatory system has been reported as a result of overexposure to Tri-Ethane®. The heart may be sensitized by Tri-Ethane®, and ventricular arrhythmia may be induced by epinephrine administration.

Liquid splashed in the eyes can result in discomfort, pain and irritation. Prolonged or repeated contact with liquid on the skin can cause irritation and dermatitis. The problem may be accentuated by liquid becoming trapped against the skin by contaminated clothing and shoes. Skin absorption can occur.

Chronic:

Prolonged exposure above the OSHA permissible exposure limits may result in liver and kidney damage. Tri-Ethane® has been extensively studied for cancer both in the U.S. and Europe by government, industry and academia in multiple species and biological test specimens. Recent reviews of these data by the Science Advisory Board to EPA's carcinogen assessment group concluded that there was no evidence to support the carcinogenicity of Tri-Ethane®. There is no documented evidence that Tri-Ethane® causes an increased cancer incidence in humans.

The data in this Material Safety Data Sheet relates only to the specific material designated and does not relate to its use in combination with any other material or process. The data contained is believed to be correct. However, since conditions of use are outside our control it should not be taken as a warranty or representation for which Hydrite Chemical Co. assumes legal responsibility. This information is provided solely for your consideration, investigation, and verification.

## EMERGENCY AND FIRST AID PROCEDURES:

**Inhalation:** Remove to fresh air. If not breathing, give artificial respiration, preferably mouth-to-mouth. If breathing is difficult, give oxygen. Call a physician.

**Eye or Skin Contact:** Flush eyes and skin with plenty of water (soap and water for skin) for at least 15 minutes, while removing contaminated clothing and shoes. If irritation occurs, consult a physician.

**Ingestion:** If conscious, drink a quart of water. DO NOT induce vomiting. Take immediately to a hospital or physician. If unconscious, or in convulsions, take immediately to a hospital or physician. DO NOT give anything by mouth to an unconscious person.

**Notes to Physician (Including Antidotes):** NEVER administer adrenalin following Tri-EthaneS overexposure. Increased sensitivity of the heart to adrenalin may be caused by overexposure to Tri-EthaneS.

## SECTION 6 . REACTIVITY DATA

|   |  |
|---|--|
| Stability:<br>Stable                        | Conditions to Avoid: Avoid open flames, hot glowing surfaces or electric arcs. |
| Hazardous Polymerization:<br>Will not occur | Conditions to Avoid:<br>None   |

**Incompatibility (Materials to Avoid):** Avoid contamination with caustic soda, caustic potash or oxidizing materials. Shock sensitive explosives may be formed.

**Hazardous Decomposition Products:** Hydrogen chloride and possibly traces of phosgene.

## SECTION 7 . SPILL OR LEAK PROCEDURES

**Steps to be Taken if Material is Spilled or Released:** Immediately evacuate the area and provide maximum ventilation. Unprotected personnel should move upwind of spill. Only personnel equipped with proper respiratory and skin/eye protection should be permitted in area. Dike area to contain spill. Take precautions as necessary to prevent contamination of ground and surface waters. Recover or absorb spilled material on sawdust or vermiculite and sweep into closed containers for disposal. After all visible traces have been removed, thoroughly wet vacuum the area. DO NOT flush to sewer. If area of spill is porous, remove as much contaminated earth and gravel, etc., as necessary and place in closed containers for disposal. (See Below)

**Waste Disposal Method:** Contaminated sawdust, vermiculite or porous surface must be disposed of in a permitted hazardous waste management facility. Recovered liquids may be reprocessed or incinerated or must be treated in a permitted hazardous waste management facility. Care must be taken when using or disposing of chemical materials and/or their containers to prevent environmental contamination. It is your duty to dispose of the chemical materials and their containers in accordance with the Clean Air Act, the Clean Water Act, the Resource Conservation and Recovery Act and all relevant state or local laws/regulations regarding disposal.

## SECTION 8 • SPECIAL PROTECTION INFORMATION

**Respiratory Protection:** For emergencies or working in confined areas, wear self-contained breathing apparatus or supplied air respiratory protection. In other circumstances involving potential overexposure, use NIOSH/MSHA-approved organic vapor respirator. (Observe limitations directed by manufacturer). Respiratory protection program must be in accordance with 29CFR 1910.134.

**Ventilation (Type):** Dilution (General) or Local Exhaust - Sufficient to maintain workplace concentration below permissible exposure limits.

**Eye Protection:** Splashproof goggles

**Gloves:** polyethylene, neoprene or polyvinyl alcohol

**Other Protective Equipment:** Safety shower and eye-wash fountain in immediate area. Personnel protective clothing and use of equipment must be in accordance with 29CFR 1910.133 and 29CFR 1910.132.

## SECTION 9 • SPECIAL PRECAUTIONS

### Precautions to be Taken During Handling and Storing:

- Do not use in poorly ventilated or confined areas.
- Tri-Ethane® vapors are heavier than air and will collect in low areas.
- Keep container closed when not in use.
- Do not store in open, unlabeled or mislabeled containers.
- Liquid oxygen or other strong oxidants may form explosive mixtures with Tri-Ethane®.
- This material or its vapors when in contact with flames, hot glowing surfaces or electric arcs can decompose to form hydrogen chloride gas and traces of phosgene.
- AVOID CONTAMINATION OF WATER SUPPLIES: Handling, storage and use procedures must be carefully monitored to avoid spills or leaks. Any spill or leak has the potential to cause underground water contamination which may, if sufficiently severe, render a drinking water source unfit for human consumption. Contamination that does occur cannot be easily corrected.

### Other Precautions:

- AVOID PROLONGED OR REPEATED BREATHING OF VAPORS. High vapor concentrations can cause dizziness, unconsciousness or death. Long term overexposure may cause liver/kidney injury.
- USE ONLY WITH ADEQUATE VENTILATION. Ventilation must be sufficient to limit employee exposure to Tri-Ethane® below OSHA permissible limits (8-hour TWA 350ppm). Observance of lower limits (outlined in Section 4) is advisable.
- AVOID CONTACT WITH EYES. Will cause irritation and pain.
- AVOID PROLONGED OR REPEATED CONTACT WITH SKIN. May cause irritation or dermatitis.
- DO NOT TAKE INTERNALLY. Swallowing may cause injury or death.
- DO NOT EAT, DRINK OR SMOKE IN WORK AREAS.

## References:

1. NIOSH Registry of Toxic Effects of Chemical Substances, 1978
2. Industrial Hygiene and Toxicology, Volume II, Second Edition, F. A. Patty, 1963
3. Dangerous Properties of Industrial Materials, Fifth Edition, N. I. Sax, 1979
4. Industrial Toxicology, Hamilton and Hardy, 1974
5. Toxicity and Metabolisms of Industrial Solvents, Browning, 1965
6. Toxicology, the Basic Science of Poisons, Casarett and Doull, 1980
7. Federal Register, 45FR Hazardous Waste Management Systems Part III, Identification and Listing of Hazardous Wastes, Page 33084, May 19, 1980
8. EPA Science Advisory Board, Subcommittee on Airborne Carcinogens, September, 1980

## Comments:

The data in this Material Safety Data Sheet relates only to the specific material designated and does not relate to its use in combination with any other material or process. The data contained is believed to be correct. However, since conditions of use are outside our control it should not be taken as a warranty or representation for which Hydrite Chemical Co. assumes legal responsibility. This information is provided solely for your consideration, investigation, and verification.





Division of Vulcan Materials Company

(VU82-2)-CS-2008

# MATERIAL SAFETY DATA SHEET

(ESSENTIALLY SIMILAR TO FORM OSHA-20)

SEE IMPORTANT NOTICE ON BOTTOM OF OTHER SIDE

24 Hour Emergency Phone (316) 524-5751

## I - PRODUCT IDENTIFICATION

### MANUFACTURER'S NAME AND ADDRESS

Vulcan Materials Company, Chemicals Division, P. O. Box 7689, Birmingham, AL 35253-0689

### CHEMICAL NAME

1,1,1-Trichloroethane, Methyl Chloroform

### CHEMICAL FORMULA

CH3CCl3

DISTRIBUTION BY:

### TRADE NAME AND SYNONYMS

Solvent 111<sup>®</sup>

### CHEMICAL FAMILY

Chlorinated Hydrocarbon

2833 N. Mayfield Rd.

### CAS REGISTRY NO.

71-55-6

### DOT IDENTIFICATION NO.

UN 2831

## II - HAZARDOUS INGREDIENTS

### MATERIAL OR COMPONENT

1,1,1 Trichloroethane (stabilized)

### % (wt)

100

### PEL (Units)

350ppm

## III - PHYSICAL DATA

### BOILING POINT (°F.)

162-190°F

### SPECIFIC GRAVITY (H<sub>2</sub>O=1)

1.3

### VAPOR PRESSURE (mm Hg.)

@20°C 100

### PERCENT, VOLATILE BY VOLUME (%)

100

### VAPOR DENSITY (AIR=1)

4.5

### EVAPORATION RATE (ether=1)

0.4

### SOLUBILITY IN WATER

0.07g/100g @ 25°C

### APPEARANCE AND ODOR

Colorless clear liquid;  
mildly sweet odor.

## IV - FIRE AND EXPLOSION HAZARD DATA

### FLASH POINT (Method used)

None (TCC)

### FLAMMABLE LIMITS

Lower

Upper

in air @ 25°C

7.5% (vol)

15.0% (vol)

### EXTINGUISHING MEDIA

Foam, Dry Chemical, Carbon dioxide

### SPECIAL FIRE FIGHTING PROCEDURES

Self-contained breathing apparatus should be used in areas where 1,1,1-trichloroethane is stored.

### UNUSUAL FIRE AND EXPLOSION HAZARDS

Concentrated vapors can be ignited by high intensity heat source.

Decomposition produces hydrogen chloride.

## V - REACTIVITY DATA

### STABILITY

UNSTABLE

### CONDITIONS TO AVOID

STABLE

X

Contact with open flame, hot surfaces  
or electric arcs

### INCOMPATIBILITY (Materials to avoid)

Strong alkalis, oxidizing materials

### HAZARDOUS DECOMPOSITION PRODUCTS

Hydrogen chloride, phosgene (small amounts)

### HAZARDOUS POLYMERIZATION

MAY OCCUR

### CONDITIONS TO AVOID

WILL NOT OCCUR

X

None

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## VI - HEALTH HAZARD DATA

### OSHA PERMISSIBLE EXPOSURE LIMIT

350 ppm 8 hour TWA. (29 CFR part 1910.1000)

ACGIH: 350 ppm 8 hour TLV; 450 ppm 15 min STEL.

### EFFECTS OF OVEREXPOSURE

#### INHALATION:

Major route of exposure - low systemic toxicity; acute exposures in the 1000 ppm range cause narcosis. Overexposure can cause dizziness, drunkenness and drowsiness, unconsciousness and even death at extreme doses.

#### SKIN CONTACT/ABSORPTION:

Prolonged or repeated skin contact can cause dermatitis through defatting of skin. Absorption through skin is not a significant route of exposure - mildly irritating on contact.

#### INGESTION:

Unlikely route of exposure, ingestion of small quantities is not likely to be toxic.

#### EYES:

Mild irritation, but no corneal injury likely. May cause conjunctivitis.

### EMERGENCY AND FIRST AID PROCEDURES

#### EYES AND SKIN

Remove contaminated clothing and flush exposed areas with water for 5 to 15 minutes.

#### INHALATION

Remove to fresh air. If breathing has stopped, administer respiration or oxygen if available.

#### INGESTION

Do not induce vomiting. Call physician and obtain medical attention.

## VII - SPILL OR LEAK PROCEDURES

### STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED

Evacuate the area, ventilate, avoid breathing vapors, contain spill. Clean up area (wear protective clothing) by mopping or with absorbent material, transfer to closed container.

**WASTE DISPOSAL METHOD** Recovered liquids may be sent to a licensed reclaimer or incinerated. Contaminated absorbent material must be disposed of in a permitted waste management facility. Consult federal, state or local disposal authorities for approved procedures.

## VIII - SPECIAL PROTECTION INFORMATION

### SPECIFIC PERSONAL PROTECTIVE EQUIPMENT

**RESPIRATORY** None required when used with adequate ventilation.

**EYE** Chemical safety goggles. Contact lenses should not be worn.

**SKIN** Neoprene, viton, polyvinyl alcohol coated gloves or equivalent.

**OTHER** Protective headgear & apron when splashing is a problem.

### VENTILATION REQUIREMENTS

Sufficient to maintain below PEL.

## IX - SPECIAL PRECAUTIONS

**PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING** Avoid contact with skin & avoid breathing vapors. Pipe vents outdoors. Store in cool, dry, ventilated area. Vapors are heavier than air and will collect in low areas.

### OTHER PRECAUTIONS

Prevent moist air from entering storage. No smoking in presence of vapors.

Contact with aluminum parts in a pressurizable fluid system may cause violent reactions.

Consult equipment supplier for further information.

DATE September 1982

VMC 3259

NOTICE: Vulcan Chemicals believes that the information contained on this Material Safety Data Sheet is accurate. The suggested procedures are based on experience of the date of publication. They are not necessarily all-inclusive nor fully adequate in every circumstance. Also, the suggestions should not be confused with nor followed in violation of applicable laws, regulations, rules or insurance requirements.

NO WARRANTY, EXPRESS OR IMPLIED, OR MERCHANTABILITY, FITNESS OR OTHERWISE IS MADE.

Rec 1/23

**EXHIBIT B**



VIKING CHEMICAL COMPANY  
1827 Eighteenth Avenue  
Post Office Box 1595  
Rockford, Illinois 61110  
815-397-0500

March 18, 1988

ECOLAB INC.  
ATTN: ~~NANCY VANCE~~ WTS  
P.O. BOX 1018  
BELOIT, WI 53511

Dear Viking Customer,

Enclosed are the Material Safety Data Sheet(s) (MSDS) which provide information on products which you have previously purchased from Viking. These MSDS have either been revised since you last received them, or are for products which you have purchased from us in the recent past. Please consider them as the current copy to replace any previous version you may have received.

The distribution of these sheets is part of a continuing program at Viking of providing information and updating our valued customers. This information should be made available to any health and safety personnel in your firm as well as all employees handling these products. Any significant changes in health, safety, or environmental protection information will be promptly forwarded to you. For this reason, you may wish to maintain records of any internal distribution so that updated sheets may be forwarded to the appropriate personnel.

When a Viking Chemical product is resold in the original package with a Viking label, the reseller has the responsibility for ensuring that the Viking MSDS is provided to its purchaser, but we will gladly handle requests for MSDS's directly with them.

We appreciate your patronage and will continue to provide the quality products and service you have come to expect.

Sincerely,

VIKING CHEMICAL COMPANY  
Quality Assurance Department

Enclosure(s)

VIKING CHEMICAL COMPANY  
1827-18th Ave.  
P.O. BOX 1595  
ROCKFORD, IL 61110  
(815) 397-0500

MATERIAL SAFETY DATA SHEET

June 13, 1986

A. IDENTIFICATION AND EMERGENCY INFORMATION

PRODUCT NAME

SAFE-SOLV

CHEMICAL NAME

PETROLEUM DISTILLATE WITH ADDITIVES

PRODUCT APPEARANCE AND ODOR

water white liquid - sharp odor

EMERGENCY TELEPHONE NUMBER

CHIENTREC - 800-424-9300

VIKING CHEMICAL CO. - 815-397-0500

B. COMPONENTS AND HAZARD INFORMATION

| Hazardous Components (Specific Chemical Identity, Common Name(s)) | OSHA PEL | ACGIH TLV | Other Limits Recommended | % (optional) |
|---|----------|-----------|--------------------------|--------------|
| METHYLENE CHLORIDE  | 500ppm   |           |                          |              |
| PERCHLOROETHYLENE   | 100ppm   | 50ppm     | 100ppm (TWA)             |              |
| MINERAL SPIRITS   | 500ppm   | 100ppm    |                          |              |
|   |          |           |                          |              |
|   |          |           |                          |              |
|   |          |           |                          |              |
|   |          |           |                          |              |

HAZARDOUS MATERIALS IDENTIFICATION SYSTEM (HMIS)

Health Flammability Reactivity BASIS

1 2 0

EXPOSURE LIMIT FOR TOTAL PRODUCT BASIS

100 ppm (580 mg/m3) for an  
8-hour workday

Recommended by the American Conference of Governmental  
Industrial Hygienists (ACGIH)

C. EMERGENCY AND FIRST AID PROCEDURES

EYE CONTACT

If splashed into the eyes, flush with clear water for 15 minutes or until irritation subsides. If irritation persists, call a physician.

SKIN CONTACT

In case of skin contact, remove any contaminated clothing and wash skin thoroughly with soap and water.

INHALATION

If overcome by vapor, remove from exposure and call a physician immediately. If breathing is irregular or has stopped, start resuscitation, administer oxygen, if available.

## INGESTION

If ingested, DO NOT induce vomiting; call a physician immediately.

## D. FIRE AND EXPLOSION HAZARD INFORMATION

FLASH POINT (MINIMUM) none

ASTM D 88, Tag Closed Cup

AUTOIGNITION TEMPERATURE

Approximately 255°C (490°F)

ASTM D 2155

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA) - HAZARD IDENTIFICATION

Health Flammability Reactivity BASIS

1 2 0 Recommended by the National Fire Protection Association

### HANDLING PRECAUTIONS

Keep product away from heat, sparks, pilot lights, static electricity, and open flame.

### FLAMMABLE OR EXPLOSIVE LIMITS (APPROXIMATE PERCENT BY VOLUME IN AIR)

Estimated values: Lower Flammable Limit 0.9% Upper Flammable Limit 23.0%

### EXTINGUISHING MEDIA AND FIRE FIGHTING PROCEDURES

Foam, water spray (fog), dry chemical, carbon dioxide and vaporizing liquid type extinguishing agents may all be suitable for extinguishing fires involving this type of product, depending on size or potential size of fire and circumstances related to the situation. Plan fire protection and response strategy through consultation with local fire protection authorities or appropriate officials.

The following procedures for this type of product are based on the recommendations in the National Fire Protection Association's "Fire Protection Guide on Hazardous Materials", Eighth Edition (1984):

Use dry chemical, foam or carbon dioxide. Water may be ineffective, but water should be used to keep fire-exposed containers cool. If a leak or spill has ignited, use water spray to disperse the vapors and to protect men attempting to stop a leak. Water spray may be used to flush spills away from exposures. Minimize breathing gases, vapor, fumes or decomposition products. Use supplied-air breathing equipment for enclosed or confined spaces or as otherwise needed.

NOTE: The inclusion of the phrase "water may be ineffective" is to indicate that although water can be used to cool and protect exposed material, water may not extinguish the fire unless used under favorable conditions by experienced fire fighters trained in fighting all types of flammable liquid fires.

### DECOMPOSITION PRODUCTS UNDER FIRE CONDITIONS

Fumes, smoke, carbon monoxide, aldehydes and other decomposition products, in the case of incomplete combustion.

### "EMPTY" CONTAINER WARNING

"Empty" containers retain residue (liquid and/or vapor) and can be dangerous. DO NOT PRESSURIZE, CUT, WELD, BRAZE, SOLDER, DRILL, GRIND OR EXPOSE SUCH CONTAINERS TO HEAT, FLAME, SPARKS OR OTHER SOURCES OF IGNITION; THEY MAY EXPLODE AND CAUSE INJURY OR DEATH. Do not attempt to clean since residue is difficult to remove. "Empty" drums should be completely drained, properly bunged and promptly returned to a drum reconditioner. All other containers should be disposed of in an environmentally safe manner and in accordance with governmental regulations. For work on tanks refer to Occupational Safety and Health Administration regulations, ANSI 249.1, and other governmental and industrial references pertaining to cleaning, repairing, welding, or other contemplated operations.

## E. HEALTH AND HAZARD INFORMATION

### VARIABILITY AMONG INDIVIDUALS

Health studies have shown that many petroleum hydrocarbons and synthetic lubricants pose potential human health risks which may vary from person to person. As a precaution, exposure to liquids, vapors, mists or fumes should be minimized.

**EFFECTS OF OVEREXPOSURE** (Signs and symptoms of exposure)  
High vapor concentrations (greater than approximately 1000 ppm) are irritating to the eyes and the respiratory tract, may cause headaches and dizziness, are anesthetic, and may have other central nervous system effects.

**NATURE OF HAZARD AND TOXICITY INFORMATION**  
Prolonged or repeated skin contact with this product tends to remove skin oils possibly leading to irritation and dermatitis; however, based on human experience and available toxicological data, this product is judged to be neither a "corrosive" nor an "irritant" by OSHA criteria.

Product contacting the eyes may cause eye irritation.  
Reports of animal studies using both sexes of several species have shown that kidney damage can occur in male rats after prolonged and repeated inhalation exposures to light hydrocarbon vapors of the general type present in this product. While the damage is of a low order of severity in animals, the implications of these results for humans have not yet been determined.

Product has a low order of acute oral and dermal toxicity, but minute amounts aspirated into the lungs during ingestion may cause mild to severe pulmonary injury and possibly death.  
This product is judged to have an acute oral LD50 (rat) greater than 5 g/kg of body weight, and an acute dermal LD50 (rabbit) greater than 3.16 g/kg of body weight.

## F. PHYSICAL DATA

The following data are approximate or typical values and should not be used for precise design purposes.

**BOILING RANGE**  $> 104^{\circ}$   
Approximately

**SPECIFIC GRAVITY** (15.6 C/15.6 C)

1.0389

**VAPOR DENSITY** (AIR = 1)

$> 3.0$

**PERCENT VOLATILE BY VOLUME**

100 at 1 atm. and 25°C (77°F)

**EVAPORATION RATE** (1 ATM. AND 25°C (77°F))

(n-BUTYL ACETATE = 1)

0.6

**SOLUBILITY IN WATER** (1 ATM. AND 25°C (77°F))  
Negligible; less than 0.1%

## G. REACTIVITY

This product is stable and will not react violently with water. Hazardous polymerization will not occur. Avoid contact with strong oxidants such as liquid chlorine, concentrated oxygen, sodium hypochlorite or calcium hypochlorite.

Metals aluminum and zinc powders should be avoided.

## H. SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED  
Shut off and eliminate all ignition sources. Keep people away. Recover from product. Add sand, earth or other suitable absorbent to spill area. Minimize breathing vapors. Minimize skin contact. Ventilate confined spaces. Open all windows and doors. Keep product out of sewers and watercourses by diking or impounding. Advise authorities if product has entered or may enter

sewers, watercourses, or extensive land areas. Assure conformity with applicable governmental regulations. Continue to observe precautions for volatile, combustible vapors from absorbed material.

## I. PROTECTION AND PRECAUTIONS

### VENTILATION

Use only with ventilation sufficient to prevent exceeding recommended exposure limit or buildup of explosive concentrations of vapor in air. Use explosion-proof equipment. No smoking or open lights.

### RESPIRATORY PROTECTION

Use supplied-air respiratory protection in confined or enclosed spaces, if needed.

### PROTECTIVE GLOVES

Use chemical-resistant gloves, if needed, to avoid prolonged or repeated skin contact.

### EYE PROTECTION

Use splash goggles or face shield when eye contact may occur.

### OTHER PROTECTIVE EQUIPMENT

Use chemical-resistant apron or other impervious clothing, if needed, to avoid contaminating regular clothing which could result in prolonged or repeated skin contact.

### WORK PRACTICES / ENGINEERING CONTROLS

Keep containers and storage containers closed when not in use. Do not store near heat, sparks, flame or strong oxidants. To prevent fire or explosion risk from static accumulation and discharge, effectively ground product transfer system in accordance with the National Fire Protection Association standard for petroleum products.

### PERSONAL HYGIENE

Minimize breathing vapor or mist. Avoid prolonged or repeated contact with skin. Remove contaminated clothing; launder or dry-clean before reuse. Remove contaminated shoes and thoroughly clean and dry before reuse. Cleanse skin thoroughly after contact, before breaks and meals, and at end of work period. Product is readily removed from skin by waterless hand cleaners followed by washing thoroughly with soap and water.

## J. TRANSPORTATION INFORMATION

### TRANSPORTATION INCIDENT INFORMATION

For further information relative to spills resulting from transportation incidents, refer to latest Department of Transportation Emergency Response Guidebook for Hazardous Materials Incidents, DOT P 5800.3.

## K. ADDITIONAL INFORMATION

**NOTE TO PHYSICIAN:** Because rapid absorption may occur through lungs if aspirated and cause systemic effects, the decision of whether to induce vomiting or not should be made by an attending physician. If lavage is performed, suggest endotracheal and/or esophageal control. Danger from lung aspiration must be watched against toxicity when considering emptying the stomach. Exposure may increase "myocardial irritability." Do not administer sympathomimetic drugs unless absolutely necessary. No specific antidote. Supportive care. Treatment based on judgment of the physician in response to reactions of the patient.



**EXHIBIT C**

# U.S. DEPARTMENT OF LABOR

WAGE AND LABOR STANDARDS ADMINISTRATION  
Bureau of Labor Standards

## MATERIAL SAFETY DATA SHEET

B

### SECTION I

|  |                        |  |
|--|------------------------|--|
| MANUFACTURER'S NAME<br><b>MAGNUS DIVISION, ECONOMICS LABORATORY, INC.</b>                                |                        | EMERGENCY TELEPHONE NO.<br><b>612-224-4678</b>   |
| ADDRESS (Number, Street, City, State, and ZIP Code)<br><b>Osborn Building, St. Paul, Minnesota 55102</b> |                        |  |
| CHEMICAL NAME AND SYNONYMS<br><b>N.A.</b>  |                        | TRADE NAME AND SYNONYMS<br><b>MAGNUS SOLVENT</b> |
| CHEMICAL FAMILY<br><b>Solvent</b>  | FORMULA<br><b>N.A.</b> |  |

### SECTION II HAZARDOUS INGREDIENTS

| PAINTS, PRESERVATIVES, & SOLVENTS | % | TLV (Units) | ALLOYS AND METALLIC COATINGS           | % | TLV (Units) |
|-----------------------------------|---|-------------|--|---|-------------|
| PIGMENTS                          |   |             | BASE METAL                             |   |             |
| CATALYST                          |   |             | ALLOYS                                 |   |             |
| VEHICLE                           |   |             | METALLIC COATINGS                      |   |             |
| SOLVENTS                          |   |             | FILLER METAL PLUS COATING OR CORE FLUX |   |             |
| ADDITIVES                         |   |             | OTHERS                                 |   |             |
| OTHERS                            |   |             |  |   |             |

| HAZARDOUS MIXTURES OF OTHER LIQUIDS, SOLIDS, OR GASES | %  | TLV (Units) |
|---|----|-------------|
| Methylene Chloride                                    | 30 | 200ppm      |
| Aromatic Hydrocarbon                                  | 30 | 200ppm      |
| 1,1,1 Trichloroethane                                 | 30 | 350ppm      |

### SECTION III PHYSICAL DATA

|   |            |                                       |       |
|---|------------|---------------------------------------|-------|
| BOILING POINT (°F.)   | 103°F      | SPECIFIC GRAVITY (H <sub>2</sub> O=1) | 1.141 |
| VAPOR PRESSURE (mm Hg.)   | 113        | PERCENT VOLATILE BY VOLUME (%)        | 100   |
| VAPOR DENSITY (AIR=1)   | unknown    | EVAPORATION RATE (n-Butyl = 1)        | > 1   |
| SOLUBILITY IN WATER   | negligible | Acetate                               |       |
| APPEARANCE AND ODOR <b>Clear, Colorless Liquid - Solvent Odor</b> |            |                                       |       |

### SECTION IV FIRE AND EXPLOSION HAZARD DATA

|                                    |                 |                  |      |     |     |
|------------------------------------|-----------------|------------------|------|-----|-----|
| FLASH POINT (Minimum used)         | None to boiling | FLAMMABLE LIMITS | N.A. | LeI | UoI |
| EXTINGUISHING MEDIA                | N.A.            |                  |      |     |     |
| SPECIAL FIRE FIGHTING PROCEDURES   | N.A.            |                  |      |     |     |
| UNUSUAL FIRE AND EXPLOSION HAZARDS | none            |                  |      |     |     |

## SECTION V. HEALTH HAZARD DATA

THRESHOLD LIMIT VALUE

N.A.

EFFECTS OF OVEREXPOSURE

Inhalation: Severe cases-Marcosis, may resemble alcoholic intoxication, rapid pulse mental confusion. Mild case-Nausea, vomiting, headache. Eyes: Burning, tearing. Skin Contact: Dermatitis.

EMERGENCY AND FIRST AID PROCEDURES

EXTERNAL: Wash skin thoroughly with soap and clean water. Remove contaminated clothing and wash before reuse. EYES: Immediately flush with plenty of running water for at least 15 minutes. INTERNAL: If swallowed, DO NOT induce vomiting. Call a physician immediately. INHALATION: Immediately move to fresh air. GET MEDICAL ATTENTION IMMEDIATELY.

## SECTION VI. REACTIVITY DATA

STABILITY

UNSTABLE

CONDITIONS TO AVOID

STABLE

X

INCOMPATIBILITY (Materials to avoid)

Strong Oxidizers

HAZARDOUS DECOMPOSITION PRODUCTS

Oxides of Carbon and Chlorine

HAZARDOUS

POLYMERIZATION

MAY OCCUR

CONDITIONS TO AVOID

WILL NOT OCCUR

X

## SECTION VII. SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED

Use commercial absorbent to remove spill. Dispose of absorbent in accordance with local regulations. Wash area with mild alkaline detergent.

WASTE DISPOSAL METHOD

Dispose of per local ordinances regarding disposal of chlorinated solvents.

## SECTION VIII. SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION (Specify type)

Air respirator

VENTILATION

LOCAL EXHAUST

Capture Velocity 50-100 FPM

SPECIAL

MECHANICAL (General)

OTHER

PROTECTIVE GLOVES

Gauntlet type Neoprene Gloves

EYE PROTECTION

Goggles - Face Shield

OTHER PROTECTIVE EQUIPMENT

Neoprene Apron &amp; Boots

## SECTION IX. SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING

Use only with adequate ventilation. Store in a cool place in original container and protect from direct sunlight. Vent off possible internal pressure by cautiously loosening bung.

OTHER PRECAUTIONS

CAUTION: Contains chlorinated solvent. Harmful if swallowed. Avoid prolonged breathing of vapor. Protect skin and eyes from contact with this product-causes irritation. KEEP OUT OF REACH OF CHILDREN.

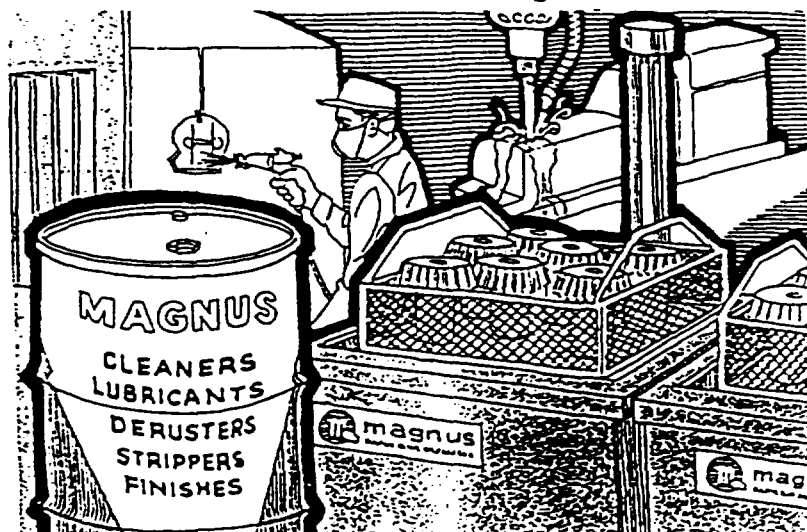
**MAGNUS**  
**SOLVENT**  
**NO. 2**

A Liquid Product

# Degreasing of Metal Surfaces

## ADVANTAGES

- FAST DISSOLVING ACTION ON GREASES AND OILS
- DRIES QUICKLY AND LEAVES NO RESIDUE
- NON-CORROSIVE TO METALS
- NON-FLAMMABLE AND NON-EXPLOSIVE
- CONTAINS NO CARBON TETRACHLORIDE



## Product Use

MAGNUS SOLVENT NO. 2 is used for a wide variety of cleaning jobs where greases and oils, such as cutting and stamping oils, are to be removed from metal surfaces. It is particularly suited for any metal cleaning operation where a non-flammable solvent is required.

MAGNUS METHODS



FOR INDUSTRY

Printed in U.S.A.

MAGNUS METHOD ECONOMICS LABORATORY, INC.

OSBORN BUILDING, ST. PAUL, MINNESOTA 55102

# **MAGNUS SOLVENT NO. 2**

**A Liquid Product**

## **PRODUCT DESCRIPTION**

MAGNUS SOLVENT NO. 2 is a clear, colorless liquid blend of selected solvents of the chlorinated and petroleum hydrocarbon types.

## **TECHNICAL DATA**

Form: Thin clear liquid  
Flash Point: None  
Specific Gravity: 1.23  
Stability: Very stable  
Freeze Point: None

## **DIRECTIONS FOR USE**

MAGNUS SOLVENT NO. 2 can be brushed or wiped over the parts to be cleaned. It can also be used in a tank, wherein the parts to be cleaned are immersed in SOLVENT NO. 2 until clean. A second tank containing SOLVENT NO. 2 is often used for rinsing parts, particularly when very clean work is desired.

In some cases, the use of a coarse spray method at close range is applicable.

To hasten the drying of the parts, an air blow-off may be used.

Keep tanks covered when not in use in order to minimize loss by evaporation.

## **PRECAUTIONS**

Contains chlorinated solvents.

Use only with adequate ventilation.

Avoid prolonged or repeated contact with skin.

Avoid breathing vapor.

Vent off possible internal pressure by cautiously loosening drum bung.

Do not use or store contents near heat or fire.

## **CONTAINERS**

MAGNUS SOLVENT NO. 2 is available in 55 and 15 gallon drums and 5 gallon cans.

MAGNUS METHODS



FOR INDUSTRY

# **MAGNUS DIVISION**

**CONOMICS LABORATORY, INC.**

OSBORN BUILDING, ST. PAUL, MINNESOTA 55102 (612) 224-4878

WAGE AND LABOR STANDARDS ADMINISTRATION  
Bureau of Labor Standards

# MATERIAL SAFETY DATA SHEET

## SECTION 1

|   |   |
|---|---|
| SECTION 1   |   |
| MANUFACTURER'S NAME<br>MAGNUS DIVISION, ECONOMICS LABORATORY, INC.                                | EMERGENCY TELEPHONE NO.<br>612-224-4678 |
| ADDRESS (Number, Street, City, State, and ZIP Code)<br>Osborn Building, St. Paul, Minnesota 55102 |   |
| CHEMICAL NAME AND SYNONYMS<br>N.A.  |   |
| CHEMICAL FAMILY<br>Solvent  | FORMULA                                 |

## SECTION II - HAZARDOUS INGREDIENTS

| PAINTS, PRESERVATIVES, & SOLVENTS                     | % | TLV<br>(Units) | ALLOYS AND METALLIC COATINGS              | %  | TLV<br>(Units) |
|---|---|----------------|---|----|----------------|
| PIGMENTS  |   |                | BASE METAL                                |    |                |
| CATALYST  |   |                | ALLOYS                                    |    |                |
| VEHICLE   |   |                | METALLIC COATINGS                         |    |                |
| SOLVENTS  |   |                | FILLER METAL<br>PLUS COATING OR CORE FLUX |    |                |
| ADDITIVES   |   |                | OTHERS                                    |    |                |
| OTHERS  |   |                |   |    |                |
| HAZARDOUS MIXTURES OF OTHER LIQUIDS, SOLIDS, OR GASES |   |                |   | %  | TLV<br>(Units) |
| Orthodichlorobenzene                                  |   |                |   | 5  | 50ppm          |
| Methylene Chloride                                    |   |                |   | 10 | 200ppm         |
| Aliphatic Hydrocarbon                                 |   |                |   | 20 | 500ppm         |
| Perchlorethylene                                      |   |                |   | 55 | 100ppm         |

### SECTION III PHYSICAL DATA

|                         |  |   |       |
|-------------------------|--|---|-------|
| BOILING POINT (°F.)     | > 1030°  | SPECIFIC GRAVITY (H <sub>2</sub> O = 1) | 1.240 |
| VAPOR PRESSURE (mm Hg.) | 58   | PERCENT VOLATILE BY VOLUME (%)          | 100   |
| VAPOR DENSITY (AIR = 1) | unknown  | EVAPORATION RATE (n-Butyl = 1)          | > 1   |
| SOLUBILITY IN WATER     | negligibl                                      | Acetate                                 |       |
| APPEARANCE AND ODOR     | Light yellow liquid - Chlorinated solvent odor |   |       |

#### SECTION IV FIRE AND EXPLOSION HAZARD DATA

|                              |      |                  |      |     |      |
|------------------------------|------|------------------|------|-----|------|
| FLIGHT POINT (OPTIONAL CODE) | None | FLAMMABLE LIMITS | None | Lat | Long |
| EXTINGUISHING MEDIA          | None |                  |      |     |      |
| SPECIAL REQUIREMENTS         | None |                  |      |     |      |
|                              |      |                  |      |     |      |
| UNUSUAL COMMENTS             | None |                  |      |     |      |

## SECTION V HEALTH HAZARD DATA

DECOMPOSITION DATA

N.A.

EFFECTS OF OVEREXPOSURE

Inhalation: Severe cases-Narcosis, may resemble alcoholic intoxication, rapid pulmonary congestion. Mild case-Nausea, vomiting, headache. Eyes: Burning, tearing. Skin contact: Dermatitis.

FIRST AID AND FIRST AID PROCEDURES

EXTERNAL: Wash skin thoroughly with soap and clean water. Remove contaminated clothing and wash before reuse. EYES: Immediately flush with plenty of running water for at least 15 minutes. INTERNAL: If swallowed, DO NOT induce vomiting. Call a physician immediately. INHALATION: Immediately move to fresh air. GET MEDICAL ATTENTION IMMEDIATELY.

## SECTION VI REACTIVITY DATA

|                                      |                |                     |
|--------------------------------------|----------------|---------------------|
| STABILITY                            | UNSTABLE       | CONDITIONS TO AVOID |
| STABLE                               | X              |                     |
| INCOMPATIBILITY (Materials to avoid) |                |                     |
| Strong oxidizing agents              |                |                     |
| HAZARDOUS DECOMPOSITION PRODUCTS     |                |                     |
| Oxides of Chlorine & Carbon          |                |                     |
| HAZARDOUS POLYMERIZATION             | MAY OCCUR      | CONDITIONS TO AVOID |
|                                      | WILL NOT OCCUR | X                   |

## SECTION VII SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED

Absorb with commercially available absorbent. Wash remaining area with mild alkaline detergent.

WASTE DISPOSAL METHOD

Consult local regulations governing the disposal of chlorinated solvents.

## SECTION VIII SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION (Specify type)

Air respirator

|  |  |   |
|--|--|---|
| VENTILATION  | LOCAL EXHAUST<br>50-100 FPM Capture Velocity | SPECIAL                                 |
|  | MECHANICAL (General)                         | OTHER                                   |
| PROTECTIVE GLOVES<br>Neoprene, Gauntlet              |  | EYE PROTECTION<br>Goggles - Face Shield |
| OTHER PROTECTIVE EQUIPMENT<br>Neoprene Apron & Boots |  |   |

## SECTION IX SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING

Use only with adequate ventilation. Store in a cool place in original container and protect from direct sunlight. Vent off possible internal pressure by cautiously loosening bung.

CAUTION: Contains chlorinated solvent. Harmful if swallowed. Avoid breathing of vapor. Protect skin and eyes from contact with this product.

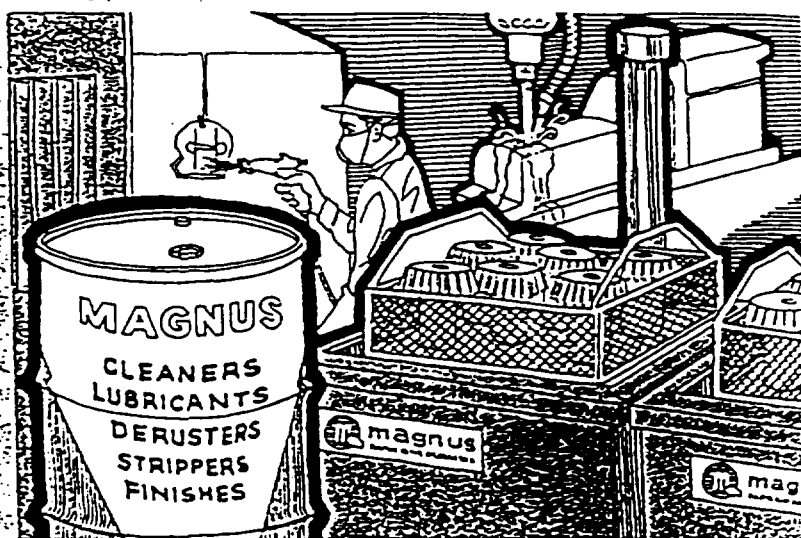
**MAGNUS****SOLVENT  
NO. 5**

A Liquid Solvent

# Cleaning Of Electric Motors

## ADVANTAGES

- CONTAINS NO CARBON TETRACHLORIDE.
- NO FLASH POINT AS RECEIVED.
- EVAPORATES COMPLETELY, BUT NOT TOO RAPIDLY.
- LEAVES SURFACES DRY AND CLEAN.
- NO DISAGREEABLE ODOR.
- FAST DISSOLVING ACTION ON OILS AND GREASES.



## Product Use

MAGNUS SOLVENT NO. 5 is used for cleaning electric motors, generators, alternators, and similar electrical components. Because of its superior solvency, MAGNUS SOLVENT NO. 5 is also useful for a variety of cleaning and degreasing functions.

245209030176

MAGNUS METHODS



FOR INDUSTRY

Printed in U.S.A.

**MAGNUS DIVISION**  
(E) ECONOMICS LABORATORY, INC.



# MAGNUS. SOLVENT NO. 5

## PRODUCT DESCRIPTION

MAGNUS SOLVENT NO. 5 is a special blend of aliphatic and chlorinated solvents.

## DIRECTIONS

For Cleaning Electric Motors

1. Immerse motor in SOLVENT NO. 5
2. Let soak for 5 to 10 minutes.
3. Run under own power while immersed for 15 to 20 seconds.
4. Let soak for 5 to 10 minutes.
5. Run under own power again while immersed for 15 to 20 seconds.
6. Remove and let drain.
7. Blow off with compressed air.
8. Lubricate motor.

Other parts or units — wipe on with a cloth dampened with SOLVENT NO. 5 or brush or spray on. When spraying, use a coarse spray at close range. Can also be used in a tank when it is desired to soak the parts. Cover the tank or container when not in use to avoid evaporation losses.

## TECHNICAL DATA

Form: A clear, water white liquid.  
Flash Point: None at boiling; 140°F. after 50% evaporation.  
Specific Gravity: 1.24 @ 70°F.  
Stability: Clear as received. Stable after repeated freeze-thaw cycles.  
Freeze Point: Less than -36°F.  
Dielectric Strength: 5,000 volts

## PRECAUTIONS

### WARNING — VAPOR HARMFUL

- Contains chlorinated solvents.
  - Use only with adequate ventilation.
  - Avoid prolonged or repeated contact with skin.
  - Avoid breathing vapor.
  - Do not take internally.
- Vent off possible internal pressure by cautiously loosening bung.



**MAGNUS DIVISION**

**EL CONDOMIOS LABORATORY, INC.**

**MAGNUS**

# **Solvent No. 5**

## **Description**

Magnus SOLVENT NO. 5 is a chlorinated solvent degreaser used for cleaning electric motors, generators, alternators, and similar electrical components. Because of its excellent solvency, Magnus SOLVENT NO. 5 is also useful for a variety of cleaning and degreasing functions.

## **Benefits**

- Contains no carbon tetrachloride
- No flash point as received
- Evaporates completely, but not too rapidly
- Leaves surfaces dry and clean
- No disagreeable odor
- Fast dissolving action on oils and greases

# Solvent No. 5

## Use Instructions:

Magnus SOLVENT NO. 5 is a chlorinated solvent degreaser used for cleaning electric motors, generators, alternators, and similar electrical components. Because of its excellent solvency, Magnus SOLVENT NO. 5 is also useful for a variety of cleaning and degreasing functions.

### For Cleaning Electric Motors

1. Immerse motor in SOLVENT NO. 5.
2. Let soak for 5 to 10 minutes.
3. Run under own power while immersed for 15 to 20 seconds.
4. Let soak for 5 to 10 minutes.
5. Run under own power again while immersed for 15 to 20 seconds.
6. Remove and let drain.
7. Blow off with compressed air.
8. Lubricate motor.

Other parts or units—wipe on with a cloth dampened with SOLVENT NO. 5 or brush or spray on. When spraying, use a coarse spray at close range. Can also be used in a tank when it is desired to soak the parts. Cover the tank or container when not in use to avoid evaporation losses.

### Description:

Magnus SOLVENT NO. 5 is a special blend of aliphatic and chlorinated solvents.

### Technical Data:

Form: A clear, water white liquid  
Flash Point: None at boiling; 140°F.  
(60°C.) after 50% evaporation.  
Specific Gravity at 70°F.: 1.24  
Stability: Clear as received. Stable after repeated freeze-thaw cycles.  
Freeze Point: Less than -36°F.  
(-37.8°C.)  
Dielectric Strength: 5,000 volts

### Storage:

Store in a cool place in original container and protect from sunlight. Vent off possible internal pressure by cautiously loosening bung.

### Precautions:

**CAUTION:** Contains chlorinated solvent. Harmful if swallowed. Avoid prolonged breathing of vapor. Use only with adequate ventilation. Protect skin, eyes and mucous membranes from contact with this product—causes irritation.

**KEEP OUT OF REACH OF CHILDREN**

### FIRST AID:

**EXTERNAL:** Wash skin thoroughly with soap and clean water. Remove contaminated clothing and wash before reuse.

**EYES:** Immediately flush with plenty of running water for at least 15 minutes.

**INTERNAL:** If swallowed, DO NOT induce vomiting. Call a physician immediately.

**INHALATION:** Immediately move to fresh air.

**GET MEDICAL ATTENTION IMMEDIATELY**

**MAGNUS**

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